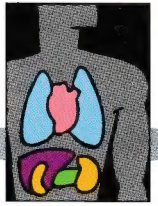
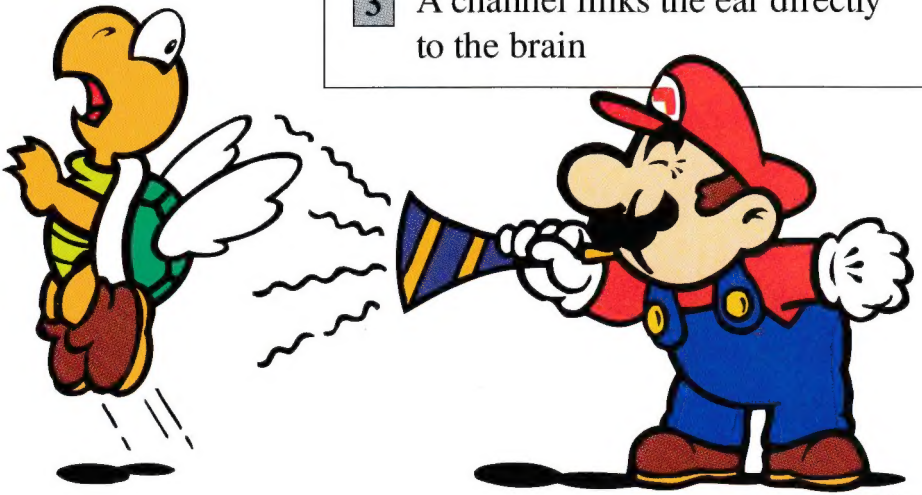
How do we hear?



THE HUMAN BODY

1. Sound waves cause our eardrums to vibrate
2. A fine membrane in the depths of the ear works like a microphone
3. A channel links the ear directly to the brain

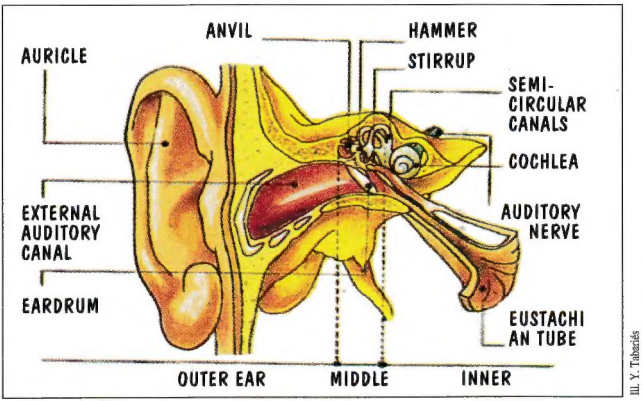


© 1995 Nintendo

Eardrums

Sound waves are conducted by the auricle into the external auditory canal (both part of the outer ear) where the waves vibrate against the eardrum.

1 We hear because sound waves vibrate on our eardrums.



Ill. Y. Tabarés

This diagram shows the various parts of the ear.

Vibrations

The eardrum, a thin membrane separating the middle ear from the outer ear, transmits vibrations through three tiny bones (ossicles): the hammer, anvil, and stirrup.

The Inner Ear

The Organ of Corti, the sensory organ of hearing, is located in the fluid-filled inner ear. When the ossicles vibrate the liquid, they are transmitting those vibrations to the Organ of Corti. There the vibrations convert to nerve impulses that send information to the part of the brain that controls hearing, and you hear!

The inner ear also has canals filled with a fluid that acts as a "level," giving us our sense of balance.

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D3 054 02-13

How does pain travel from your skin to your brain?

THE HUMAN BODY

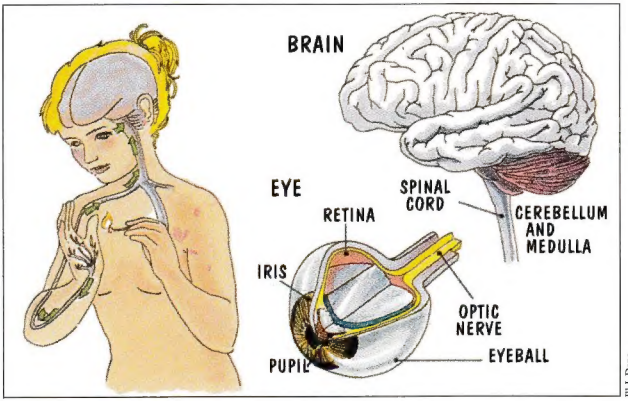
1. Through the blood
2. Through the heart
3. Via the nerves

©1995 Nintendo

Nerves

You can feel contact, painful or otherwise, through your nerve endings and through your mucous membranes.

3 Pain travels via the nerves to the brain.



A reflex action makes us withdraw a hand from heat, but our brains can actually counteract this.

High-Speed Messages

Nerve endings react to painful stimulation, like pricking or burning. For example, let's say you touch something very hot. The nerve endings in your fingers immediately send a message to your spinal cord. It instantly makes your muscles contract, so you pull your hand away before it gets burned. At the same time, another message is sent to your brain so you understand what's happening! And if the message gets to your speech center, you might even say "OW!"

Controlling Pain

Your brain decides whether to allow a reflex action, like blinking or sneezing, to take place. And the brain can be trained to control pain or even stop it. That's what some Indians do when they walk on hot coals.

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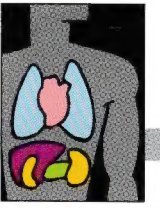
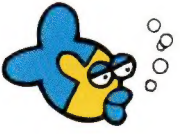
Why do we need oxygen?



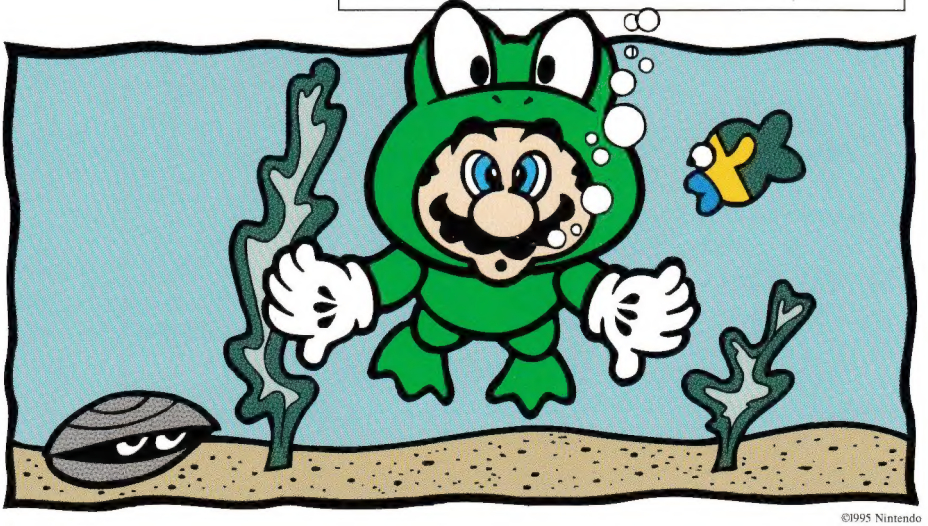
THE HUMAN BODY



1 To smell

2 To breathe and live

3 To digest food

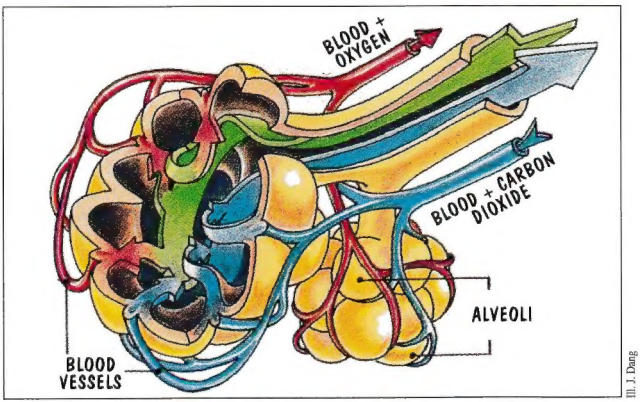


©1995 Nintendo

Oxygen

We need oxygen to stay alive, just as a car needs fuel to run. We breathe air through our noses and mouths all day and night.

2 We need oxygen so that we can breathe and live.



Ill. J. Dang

When we breathe in, oxygen passes into the alveoli in the lungs: red corpuscles carry the oxygen to the cells. Carbon dioxide, produced by the cells, takes the same route back when we breathe out.

The Oxygen Trail

When we breathe in, we take in oxygen from the air around us. The red corpuscles in our blood carry that oxygen all around our bodies to provide us with the energy we need.

Like a motor, we too have to get rid of the "exhaust" created by using up the oxygen. That exhaust is carbon dioxide, and our red corpuscles carry it to our lungs, where we get rid of it by breathing out.

Our Lungs

The exchange of oxygen and carbon dioxide from the air to the blood is carried out by the lungs. There, in air cells or alveoli, through which tiny blood vessels pass, the exchange is made.

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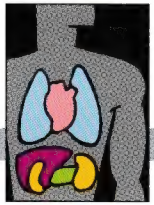
D3 054 03-10

What makes our bodies move?



THE HUMAN BODY

1. The bones
2. The muscles and nerves
3. The heart

©1995 Nintendo

Muscles

Muscles make our bones move. Muscles obey orders from the brain carried to them by nerve impulses.

2 Muscles and nerves make our bodies move.

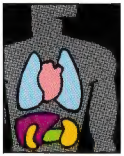


Photo Labat / Explorer

Muscles are elastic. Attached to bones, they make the bones move when they contract.

Contractions

Muscles are made up of many fibers. When these contract, they tighten up or shorten the muscle and move the bone to which they're attached.

Voluntar or Involuntary

To contract, your muscles receive a command from your brain. When nerve impulses reach the muscle in your leg, for example, it contracts and you can stand up. This is a voluntary movement.

Other muscles contract automatically, although they can be controlled. For example, you don't have to think about breathing–it's automatic. But you can deliberately hold your breath. And let's not forget the most important muscle in your body. It's automatic too – it's your heart!

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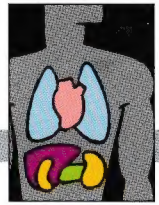
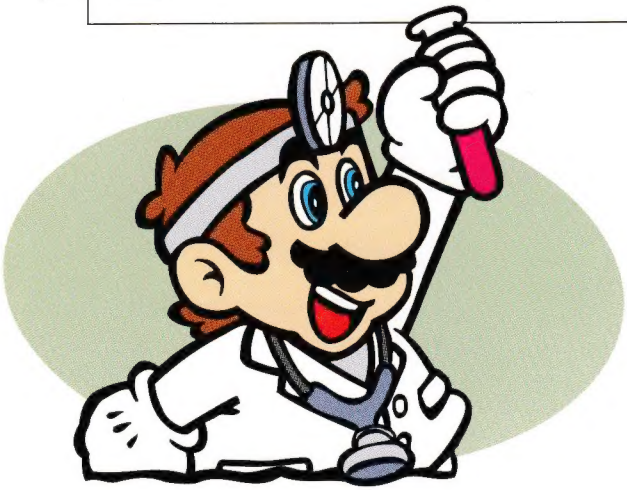
D3 054 03-11

Why is blood red?



THE HUMAN BODY

1. It constantly circulates through the body
2. Air and sunlight combine to make it appear red
3. It contains hemoglobin



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Blood

The blood of many animals, including humans, contains a red pigment or coloring matter called hemoglobin, which takes up oxygen in the lungs and carries it to other parts of the body.

3 Hemoglobin in blood makes it red.

Photo © Longcore / Science Source / Explorer

A disk-shaped red blood cell is flexible so it can easily twist around to pass through the body's micro-vessels.

Hemoglobin is present in our red blood cells. Our bodies produce over 100 million of these red blood cells in our bone marrow every minute. The cells mature in the marrow, and then move into the blood. There they tirelessly move oxygen to and from the body tissues until finally, the red blood cells are destroyed by the liver or spleen. A single red blood cell, filled with hemoglobin, lives only about 120 days. But during that time, it delivers life-giving oxygen to us.

In Search of Iron

If someone loses a lot of blood, he/she has to restock the body's supply of red blood cells. So it's important to eat foods high in iron, an ingredient necessary to the manufacturing of hemoglobin. Iron can be found in many different kinds of food, including spinach, lentils, and chocolate.

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D2 491 04-14

How many teeth does an adult human have?

THE HUMAN BODY

1 24

2 32

3 38

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Teeth

In the course of a lifetime, a person gets two sets of teeth. As an adult, a person should have a total of 32 permanent teeth.

2 An adult human has 32 teeth.

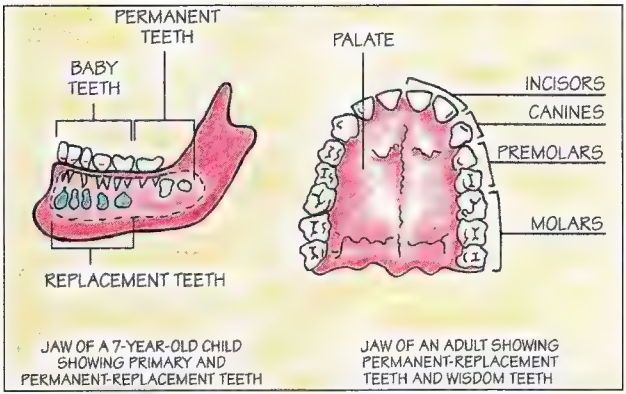

Illustration by Mimi Perrotti

(Left) Jaw of a 7-year-old child showing primary and permanent-replacement teeth. (Right) Jaw of an adult showing permanent-replacement teeth and wisdom teeth.

In childhood you get one set of 20 teeth, called baby or primary teeth. By age three, most kids have all 20 of their primary teeth. These are smaller and whiter than the teeth that replace them.

Permanent is Forever

Between ages 5-12, most children lose their baby teeth and permanent teeth replace them. By the time most young people are 18 years old, 28 of their permanent teeth are in. Then sometime after age 18, the four wisdom teeth usually appear. Some people don't get wisdom teeth until age 40, and some never get them. After the permanent teeth are in, it's up to people to brush and floss daily, and to see their dentists so the teeth will truly last forever!

Shaped for the Situation

Permanent teeth have different shapes, depending on how they're used when eating. The 8 incisors are used for chopping and biting; the 4 canines for tearing food; and the 8 premolars and 12 molars for grinding food.

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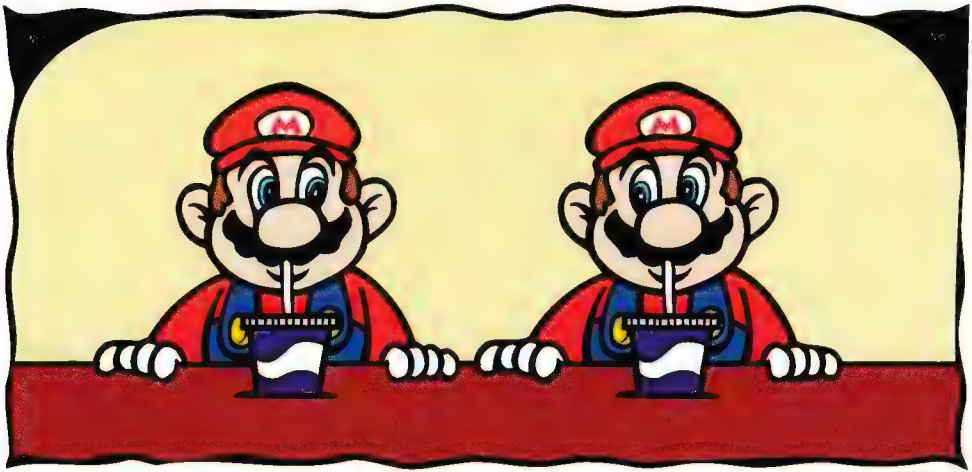
D2 491 05-12

Why are some twins identical?

THE HUMAN BODY

1. They develop from one egg
2. They are born at exactly the same time
3. They develop from two eggs



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Twins

Identical twins develop from the same fertilized egg or zygote. They are always the same sex and have the same genetic makeup.

1 Identical twins develop from one egg.

Photo © U. Markus/Explorer

The differences between identical twins are very slight…but their parents usually have no problem telling the two apart.

During the normal development of a fertilized egg, the zygote's cells split and follow a genetic code to form a single, unique baby. A genetic code includes characteristics passed along from previous generations and determines whether the baby will be blond or brunette, blue- or brown-eyed, tall or short, thin or fat.

Twin Truths

About 1 in every 89 births results in twins. And about 7 out of 10 twin births are fraternal. These two babies develop from two different eggs and may be of the same sex—two boys or two girls—or of different sexes—one boy and one girl. Each fraternal twin has his/her own unique genetic makeup.

Identical Individuals

About 4 in every 1,000 births results in identical twins. They develop after a single fertilized egg divides into two parts and grows as two separate babies. Identical twins are always the same sex—two boys or two girls—and each twin has exactly the same genetic makeup.

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D2 491 06-04

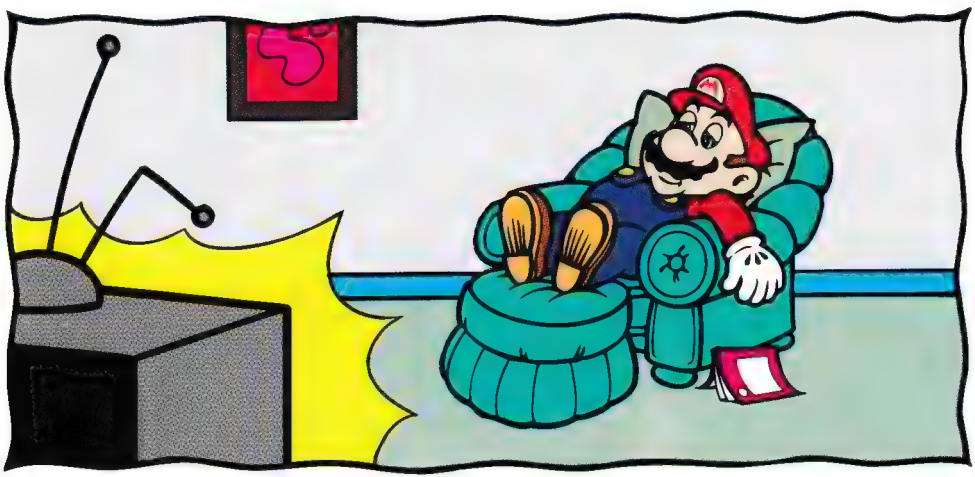
How do we see?

THE HUMAN BODY

1 With the iris

2 With the retina

3 With the jugular



©1995 Nintendo

Vision

The retina, a lining on the back wall of the eye, is essential for vision. Here a tiny picture of what we're looking at is formed.

2 It's the retina that helps us to see.

Photo © Explorer

A baby doesn't need training to see. She just has to learn the names of the objects and colors she sees.

We see an object because it reflects light to our eyes. Light rays enter the eye through the lens, the clear part of the eye. It bends the light rays to form a tiny picture of the image on the back wall of the eye, the retina. But the image is upside-down!

Right Side Up

The retina is made up of millions of cells that gather messages about the picture. The optic nerve carries the signals to the brain. The brain interprets the image and lets us see it right side up.

Vision Problems

Not everyone's lens bends light correctly to form a clear picture on the retina. Some people are near-sighted—they clearly see only things near them. Others are farsighted—they clearly see only things that are far away. If these people wear eye-glasses or contact lenses, the rays of light will bend correctly so they will see clearly.

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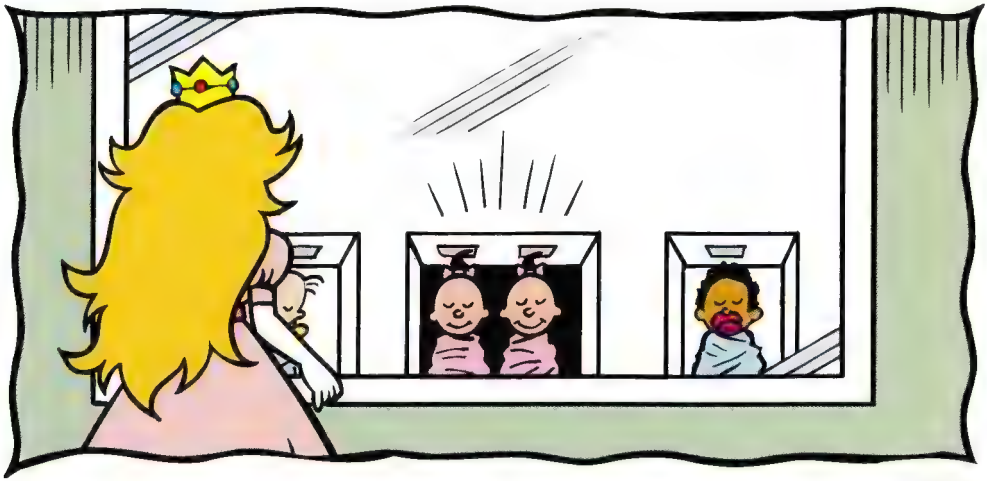
D3 054 09-10

How often do twins occur?

THE HUMAN BODY

1. About 1 in every 89 births
2. About 1 in every 250 births
3. About 1 in every 1,000 births



©1995 Nintendo

Twins

About 1 in every 89 births results in twins. The two babies may be identical twins or fraternal twins. About 7 of 10 twin births produce fraternal twins.

1 About 1 in every 89 births results in twins.

Photo © L. Maquet

Fraternal twins may resemble one another or look completely different, but they're still twins!

Twin Types

Identical twins develop after a single fertilized egg divides in two and grows as two separate babies. They are always of the same sex—two boys or two girls—and each has exactly the same genetic make-up. Fraternal twins develop from two different eggs that the mother releases at about the same time. Each egg is fertilized by a separate sperm, to create two babies, each with a different genetic makeup.

Fraternal Facts

Fraternal twins may be of the same sex—two boys or two girls—or different sexes—one boy and one girl. Either way, fraternal twins may look no more alike than any other brother and sister who are not twins. The chance of having twins is affected by a mother's race and age.

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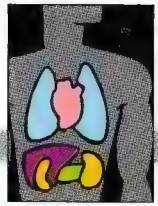
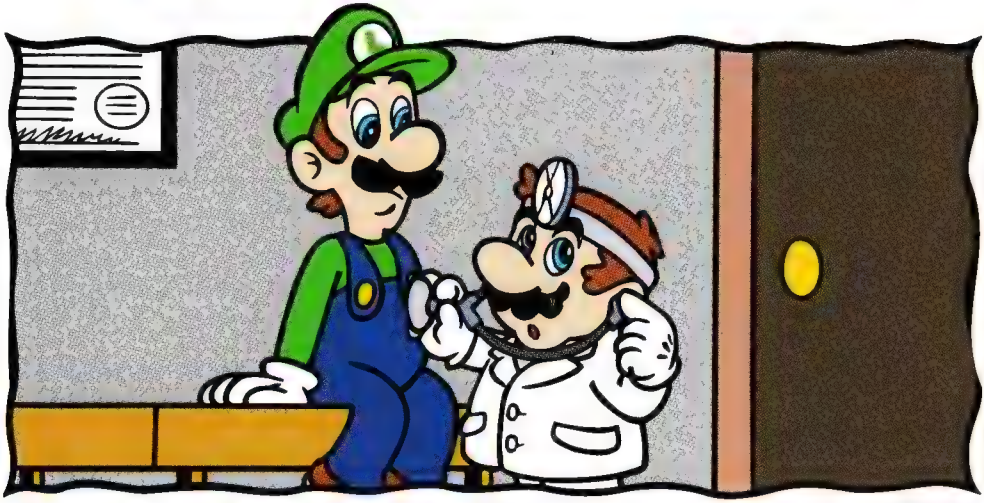
D3 054 11 05

How fast is the average resting heartbeat?



THE HUMAN BODY

1. 22 beats per minute
2. 72 beats per minute
3. 142 beats per minute



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Heartbeats

The heart, a hollow muscle about the size of a fist, beats an average of 72 times per minute. This essential organ sends life-giving blood throughout the body.

2 The average resting heart beats 72 times per minute.

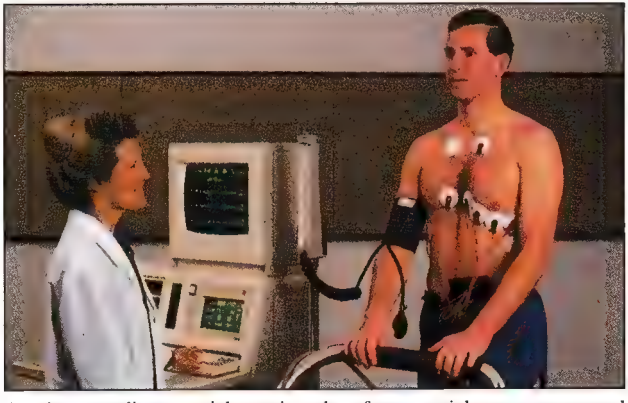

Photo © Jon Feingersh / Tom Stack Associates

An electrocardiogram picks up impulses from special sensors to record the rhythm of the heart's beats.

A person's size determines his or her resting heart rate. The bigger the person, the slower the heart rate. For example, a newborn baby's heart beats about 120 times per minute; while the typical adult's heart beats 72 times per minute. Most doctors judge a resting heart rate between 60 and 100 beats per minute to be within the normal range. When you exercise, your heart rate increases because the body needs more blood oxygen. But athletes can be trained to slow their heart rates to reduce stress on their bodies.

A Hard Worker

The average adult heart weighs between 9 and 11 ounces (255-312 g) and pumps about 2,000 gallons (7,600 l) of blood each day. So the heart of a 70-year-old person would have beat more than 2.5 billion times and pumped 51 million gallons (193 million l) of blood through his or her body!

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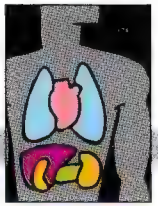
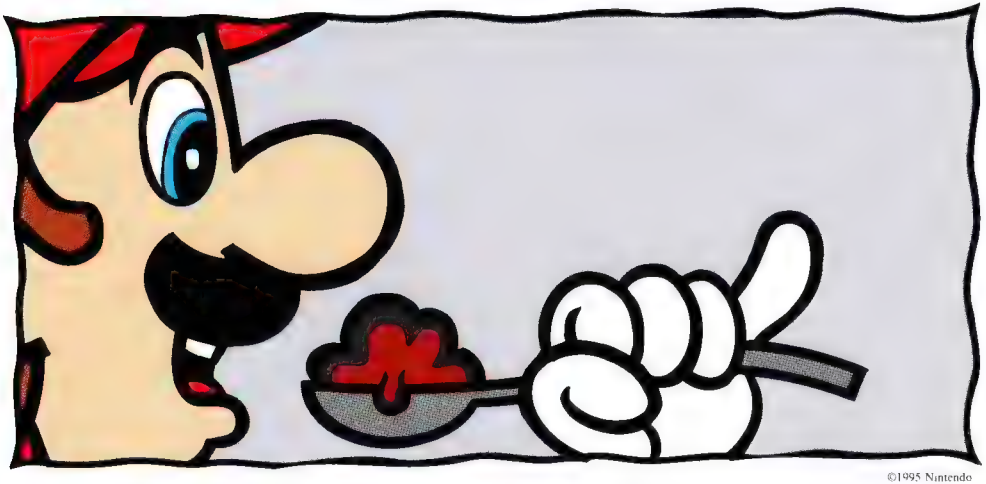
How do we taste things?



THE HUMAN BODY

1. With nerves in our tongues
2. With teeth that transmit flavors
3. With saliva



©1995 Nintendo

Taste

Taste buds, connected to nerves in our tongues, are sensitive to four basic tastes—sweet, salty, sour, and bitter. These four, in combinations or linked with odor, make up all other tastes.

1 We taste things because of the nerves in our tongues.

Photo © B. Duruel / Explorer

Did you know that if you have a cold and your nose is stuffed up, foods don't taste as good? That's because your nose helps you taste things!

All information our brains receive comes through our five senses: taste, sight, smell, touch, hearing. Receptors pick up sensations and nerves carry messages to the brain. The brain distinguishes what we've tasted, seen, smelled, touched, or heard.

A Matter of Taste

Your tongue is covered with small groups of sensory cells called taste buds. These receptors connect to the nerves in your tongue, which send taste impulses to your brain. Different areas of the tongue are especially sensitive to different tastes: sweet at the tip; salty on the front edges; sour on the sides; bitter at the base. Since food passes the nose on the way into the mouth—your sense of smell is stimulated at the same time. Your nose helps you taste. To prove it, hold your nose while tasting a cut-up white potato and a cut-up apple. You'll discover it's hard to tell one from the other!

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D3 054 13-04

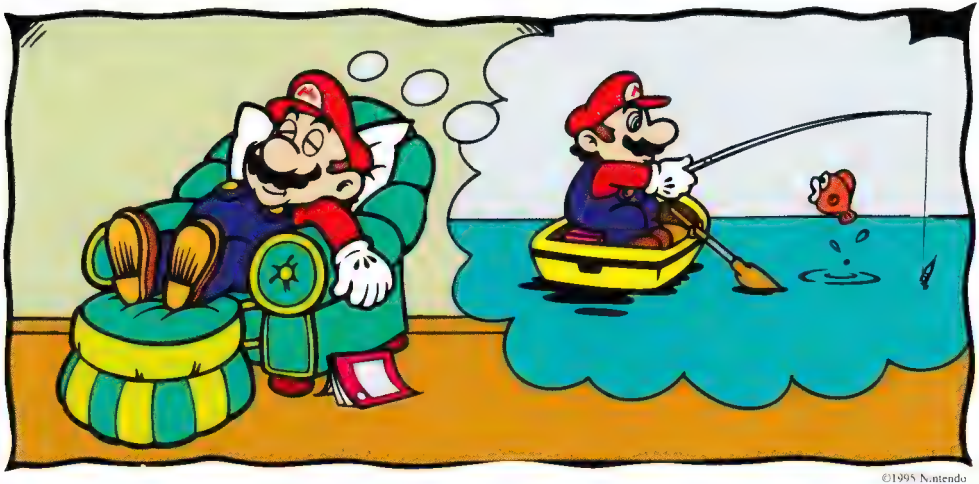
Does everyone dream?

THE HUMAN BODY

1 No, babies don't dream.

2 No, elderly people rarely dream.

3 Yes, everyone dreams.



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Dreams

Everyone dreams, even though some people think they don't. It's not that they don't dream, it's that they don't remember their dreams!

3 Yes, everyone dreams.

Photo © M. Cambazard / Explorer

Although dreams are imaginary, they often seem very real.

A dream is a story that a sleeper watches or takes part in. It's filled with images, sounds, odors, and emotions. On waking, the sleeper may remember only what happened right before he or she awoke. No one recalls every dream he's ever had.

Looking for Meaning

Events in dreams are imaginary but are related to real experiences in the sleeper's life. Sometimes dreams are realistic. If you spent the day at the beach, you might dream of the ocean at night. Other times, dreams can be symbolic. For example, in a dream a boy is walking his dog. As they walk, the dog pulls faster and faster until the boy tumbles down a hill. The dream might symbolize the fact that the dreamer is so busy—school, sports, exams, parties, family problems, and coming down with a cold—he feels he has no control over his life. It's as if life (the dog) were pulling him too fast in too many directions!

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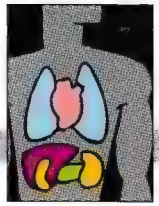
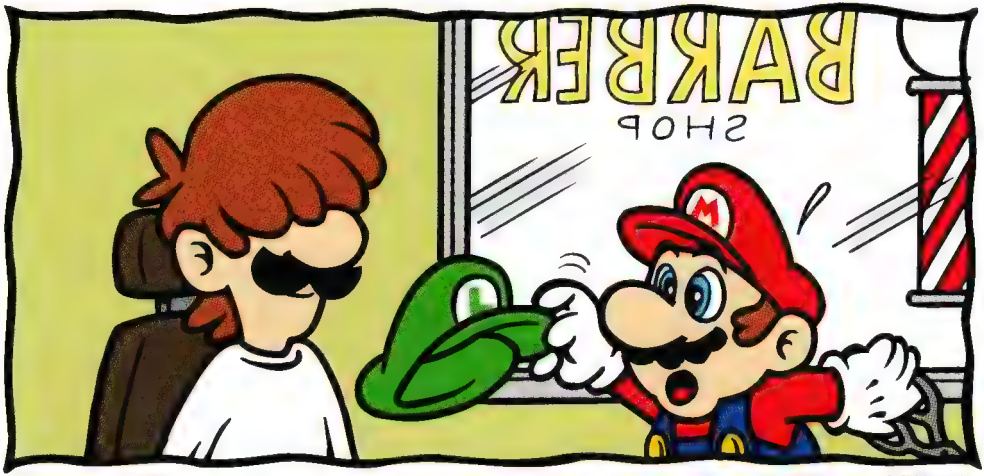
D3 054 13-05

Does your hair always grow at the same rate?



THE HUMAN BODY

1. No, it grows faster in winter.
2. No, it grows faster in summer.
3. Yes, it grows steadily all year.



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Hair

Scalp hair grows less than 1/2 inch (13 mm) per month. Children's hair grows faster than that of adults, and everyone's hair grows faster in summer than winter.

2 Your hair grows faster in the summer.

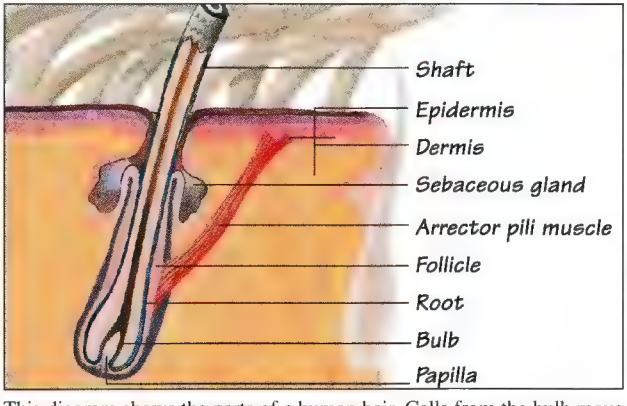

Illustration © Y. Tabarie

This diagram shows the parts of a human hair. Cells from the bulb move up to become the shaft.

Your hair may be curly or straight, blond or brunette, but everyone's hair is relatively the same in the way it grows.

From the Roots

Hair is a threadlike structure that grows from the skin. At the base of each hair, below the scalp's surface, is the follicle. This enclosure leads down to the root, which bulges at the tip into a soft bulb. Hair grows from bulb cells that move up to form the root and the shaft.

Hair Facts

Hair grows in stages. Follicles are active for 2-6 years, then rest for about 3 months. A human scalp has an average of 100,000 hairs, and 5-15 percent are in a resting stage at any given time. On average, we lose 70-100 hairs per day from those resting follicles.

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Which is the outer layer of skin?

THE HUMAN BODY

1. The dermis
2. The epidermis
3. The endodermis

©1995 Nintendo

Skin

The skin is a protective organ that covers the body. It has three layers: epidermis, or outermost layer; dermis, the middle layer; subcutaneous tissue, the innermost layer.

2 The outer layer of skin is the epidermis.

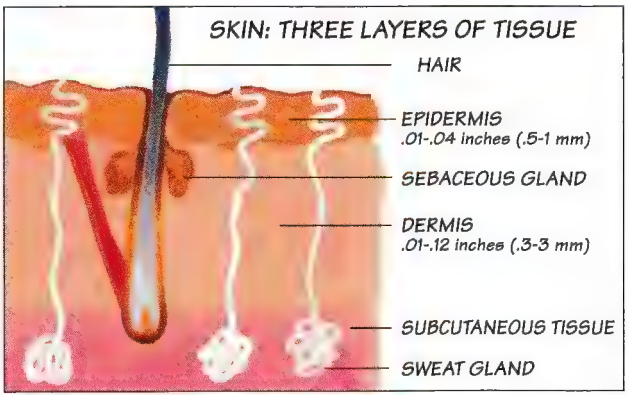

Photo © Y Tabariés

Skin breathes through the pores and must be washed regularly to prevent clogging the pores with dirt and sweat.

The epidermis, about as thick as a sheet of paper, has four layers of cells. The top layer is filled with the protein keratin, that acts as a barrier to microorganisms and waterproofs the skin. Melanin or skin pigment is also in the epidermis. And this is where dead skin cells are shed as thin flakes.

Down to Dermis

Dermis is made up mainly of nerve endings, blood vessels, and connective tissue. The blood vessels feed both the dermis and epidermis. Papillae on surface of the dermis fit into pits on the underside of the epidermis, connecting the two. The papillae contain nerve endings.

Subcutaneous Tissue

Consisting mainly of blood vessels, connective tissue, and cells that store fat, the subcutaneous tissue protects the body from blows and other injuries. It also helps to retain body heat.

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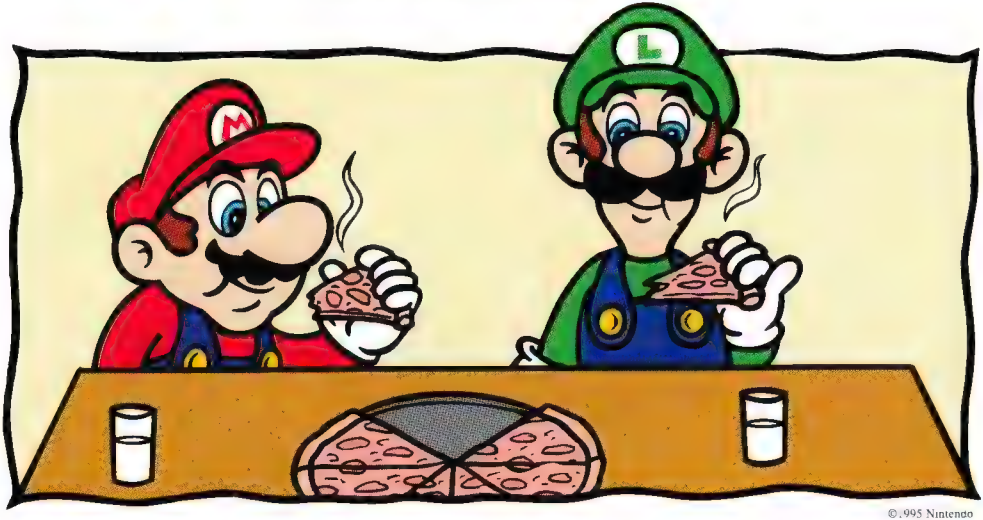
Which is the primary organ of the digestive system?

THE HUMAN BODY

1. The tongue
2. The intestines
3. The stomach

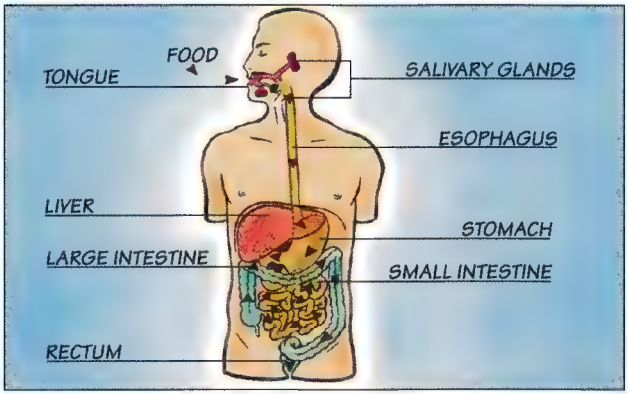


©.995 Nintendo

Digestion

The stomach is just one part of our digestive system. It holds food and helps break it down into nutrients for our bodies to absorb.

3 The stomach is the primary organ of the digestive system.



As the illustration shows, digestion is a complex process that involves many different organs, including the stomach.

We eat to get energy from food; but we can't get that energy until every piece of food has been broken down into simple solutions our bodies can absorb. That's where our digestive systems come in, using both mechanical and chemical processes to do the job.

The Inside Story

Digestion begins in your mouth. You chew and grind food into smaller pieces with your teeth. The saliva in your mouth also helps break food into smaller pieces. Then the food travels down the esophagus to your stomach, where water, enzymes, and acids break the food down even further. As the food passes through your small intestine, most of the nutrients are absorbed from it. As what's left passes through the large intestine, water and salts are absorbed. Then any leftover, undigested solids are excreted.

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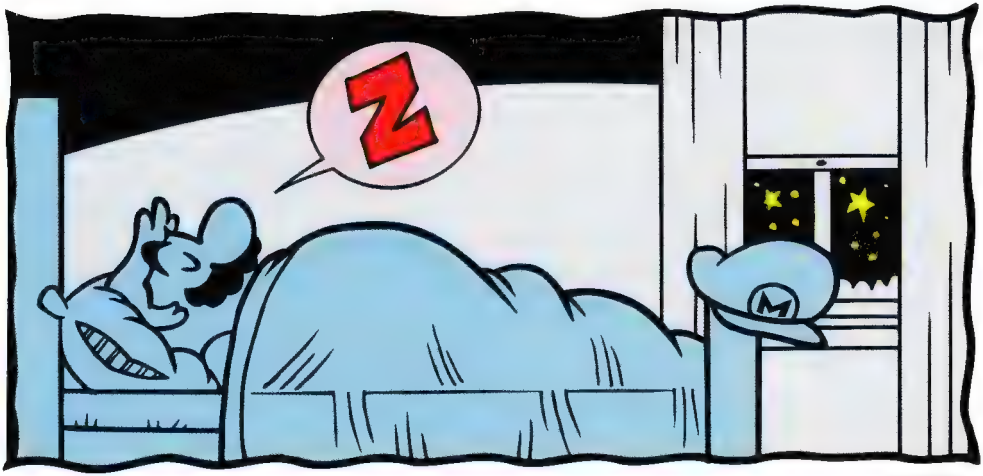
What makes us sleep?

THE HUMAN BODY

1. The muscles in our toes
2. The sleep center in our brains
3. The nerves around our eyelids



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Sleep

You have sleep and wake centers in your brain, so when you need rest, the brain sends a message telling your body to sleep. A hormone is released that makes you yawn. Your eyes feel heavy. Before long, sounds fade away, and you're asleep!

2 The sleep center in a person's brain controls sleep.

© G. Perret / Explorer

Even as a baby sleeps, her or his body is working to grow.

The need for sleep usually comes at night, but the brain could trigger sleep during the day. Many people find they get sleepy around 10 a.m. and again at 5 p.m.

How Much Sleep?

How much sleep does a person need? It depends on the person. Some get along on less sleep than others. Newborn babies are asleep more hours a day than awake. At 2-3 months, the average baby may sleep for 10-11 hours at night and still take several naps of one or more hours during the day. The average 4-year-old sleeps 10-14 hours a day, including naps, and a 10-year-old sleeps 9-12 hours a day, with no naps. Most teenagers and adults try to get 8-10 hours of sleep, but many times have to get by on less.

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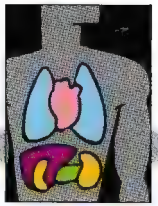
How many bones are in a human body?

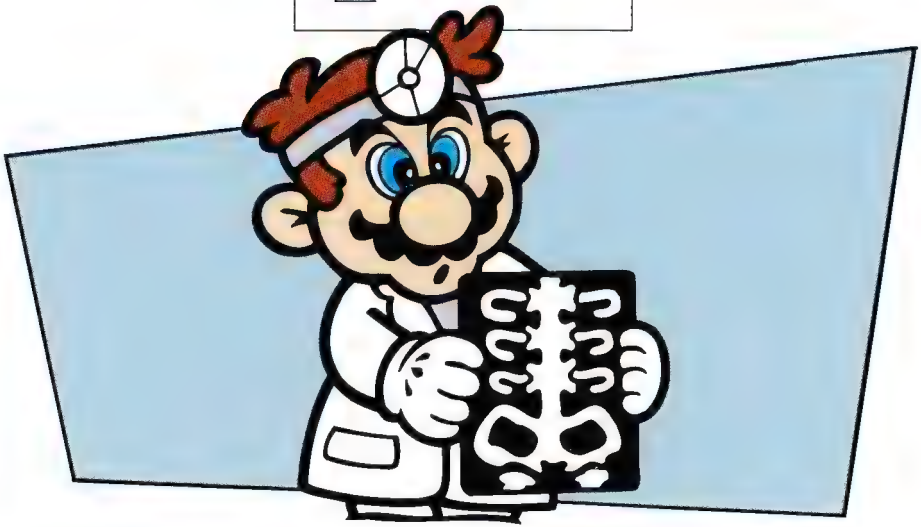


THE HUMAN BODY

1 About 206

2 About 432

3 About 500



©1995 Nintendo

Skeleton

The human body, like all vertebrate bodies, is built on a framework of bones. Bones give shape to the body, support muscles, and protect soft tissues and organs.

1 **There are about 206 different bones in the human body.**

© DR

A knee joint as seen by an X-ray machine. Cartilage allows stretch as the joint moves.

Bones are very active tissues, constantly dissolving and rebuilding. They store minerals, such as calcium phosphate, and release them as needed. That's why eating calcium-rich foods, like milk, strengthens your bones.

Bones, Bones, Bones

The most important bone in your body is the backbone, or spine. Without it you couldn't sit, stand, or move. The spine is actually a series of 33 small bones called vertebrae. The upper 25 are joined by ligaments and cartilage which make them flexible; the lower 9 are fused together. The spine supports the upper body and protects the spinal cord, which runs through it. The rib cage, made up of 12 pairs of ribs, forms a protective enclosure around the heart and lungs. Arms are joined to the backbone by the shoulder blades and collarbone; legs are joined by pelvic bones. Muscles and tendons make the skeleton move.

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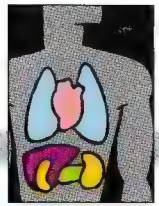
What are tears?



THE HUMAN BODY

1. Secretions from the gallbladder
2. Secretions from the lachrymal glands
3. Secretions from the femur bone

©1995 Nintendo

Tears

You have two lachrymal glands, one over each eye, under the eyelid. Constant watery secretions from each gland flow across the cornea, the tough outer layer of your eyeball.

2 Tears are secretions from the lachrymal glands.

© M. Carr / Hoa Qui

Babies' tears are their way of communicating their feelings before they can talk. What do you think each of these babies is trying to convey?

Lachrymal secretions help keep foreign matter like dust, hair, and pollen, out of your eyes. Tears are primarily composed of a salt solution, but also contain substances to help fight off bacteria, and proteins that help make the eyes immune to infections.

Why Cry

Every time you blink, a little more fluid is sucked from the lachrymal glands. If you're in an emotional state—angry, sad, laughing hard, or feeling sentimental—the muscles around the lachrymal glands tighten, squeezing out tears. After tears bathe the eyeball, they flow out through tear ducts in the corner of each eye. These ducts lead to the nasal duct running the length of your nose, finally opening inside the nostrils. That's why sometimes when you cry, your nose runs too!

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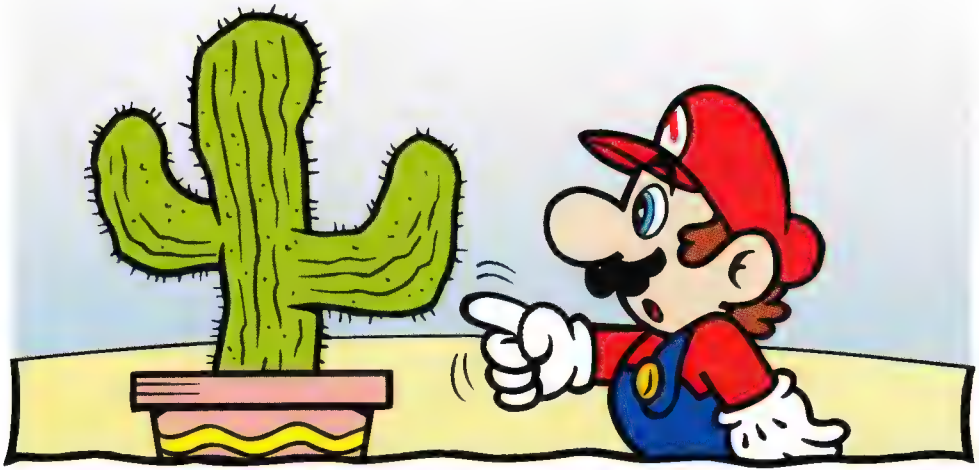
Which is most helpful for our sense of touch?

THE HUMAN BODY

1 Tongue

2 Ear

3 Hand



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Hands

We can learn many things with our sense of touch. The nerve cells in our hands help us know what our fingers are touching.

3 The hand is most helpful for the sense of touch.

© Jaubert / Sipa Press.

Her hands let the child know the lamb is soft, warm, and furry.

When your hand touches something, touch receptors, or nerve cells, in the skin transmit signals to the sensory cortex of your brain. It interprets the signals and lets you know if the object is wet, dry, soft, hard, rough, smooth, prickly, slippery, cold, hot, sharp, dull, round, square, triangular, and so on. If the nerve cells in your hands were damaged and couldn't function, you couldn't feel what you touched. You'd have to use your other four senses—sight, hearing, smell, and taste—to learn about things around you.

Thumbs Up!

The human hand, with its thumb, is specialized for grasping—just try holding on to something without using your thumb! If you look at your hand carefully, you can see the bones, muscles, and ligaments that allow you to move each finger separately, and the hand as a whole.

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How fast do our nails grow?

THE HUMAN BODY

1. About .8 inches (2 cm) every 10 days
2. About .4 inches (1 cm) every 10 days
3. About .04 inches (1 mm) every 10 days

©1995 Nintendo

Nails

At the end of the upper surface of your fingers and toes, you have hard but flexible nails. Until you cut them or they break, they'll grow about .04 inches (1 mm) longer every 10 days.

3 Our nails grow about .04 inches (1 mm) every 10 days.

© G. Ventre / Sipa Press

Most people's toenails grow faster in warm weather than in cold.

Nails, part of your epidermis or outer skin layer, are filled with keratin, a tough waterproof protein. The skin below the nail is the matrix—it's from here that the nail grows. Growth begins at the lunula, the white half-moon at the base of the nail. The plate is the hard part with all the keratin, and the bed lies under it. As new nail cells push the older cells toward the tip of the finger, the nail grows longer.

Healthy Nails

A nail that's been torn off will grow again, as long as the matrix isn't badly injured. Little white spots that show up on your nails are bruises; they grow out as your nails grow. Doctors often check a patient's nails because illness can affect nail growth—healthy nails generally denote a healthy body.

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Why do we perspire?

THE HUMAN BODY

1. To reduce body temperature
2. To get rid of waste
3. Both of the above

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Perspiration

Perspiration, or sweat, is a watery fluid secreted by our bodies. It cools our bodies as it evaporates and excretes waste products like salts from our bodies.

3 Perspiration reduces body temperature and excretes waste products from the body.

© Kid / Dorrault / Hoa-Qui

Exercise, the stress of team sports, and the weather all promote sweating.

As a living being, your body is made up mostly of water. If you get very hot, the water heats up and you sweat—your skin gets wet. Some of the sweat evaporates, pulling the heat away and bringing cooler air in toward your skin.

Glands at Work

Sweat glands, located all over your skin, are especially abundant on the palms of your hands, your forehead, the soles of your feet, and in your armpits. Most perspiration is secreted onto the skin, but some, like that in your armpits, is secreted into hair follicles. You perspire when you have a fever, when the weather's extremely hot, or when you're under physical or emotional stress. Perspiration is odorless until it mixes with bacteria on your skin. Washing and bathing helps eliminate perspiration odor.

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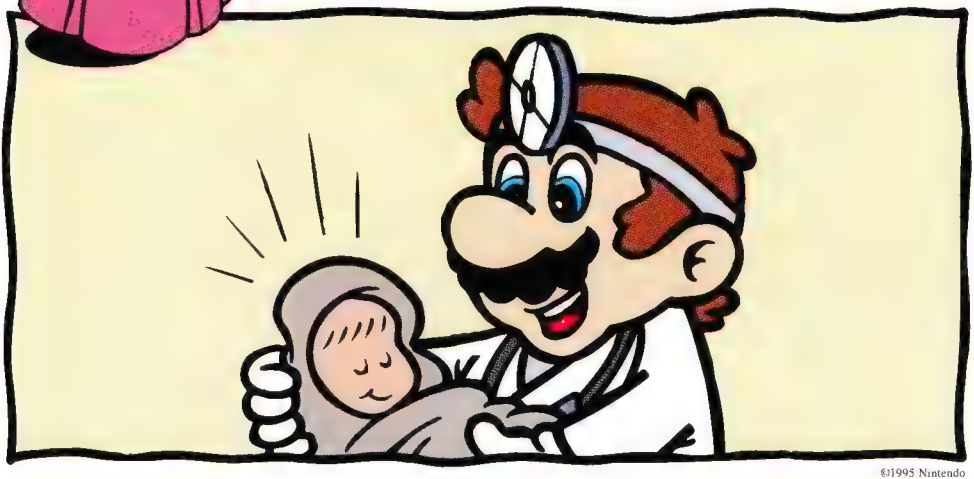
Does a baby's heart beat before it is born?

THE HUMAN BODY

1. Yes, in the fourth week of a baby's development.
2. No, it starts at birth.
3. Yes, in the third month of development.



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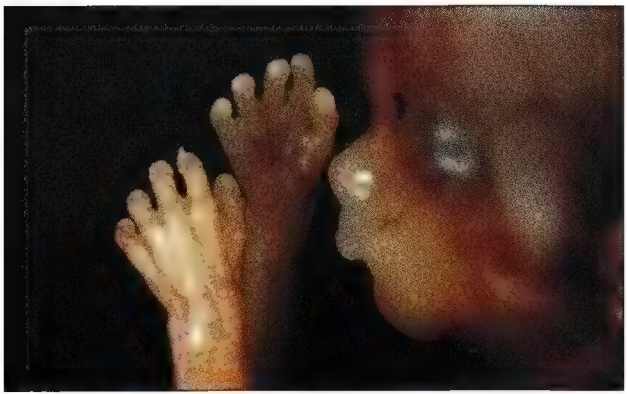
Birth

Early in the fourth week of a baby's development inside its mother, the baby's, or embryo's, tiny heart begins to beat and pump blood. After the eighth week, the embryo is called a fetus.

1 In the fourth week of a baby's development, its heart begins to beat.



© Delezoide / Sipa Press

A fetus at 10 weeks of development has a skeleton and a heart that pumps blood throughout its tiny blood vessels.

By the time an embryo becomes a fetus, it has developed skin, a head, brain, backbone, skeleton, arms, legs, ears, eyes, nose, hands, elbows, shoulders, and the beginnings of all its organs. The tiny fetus, little more than 1 inch (2.5 cm) long, continues to develop and will become 600 times heavier before it is able to survive outside its mother's body.

Final Stages

As the fetus develops, it gets finishing touches, like hair, eyelashes, and nails. The fetus moves, performing innate or inborn behavior, like thumb-sucking, swallowing, silent crying, and kicking. The mother's body changes constantly to accommodate a growing fetus, and the foods she eats give her unborn child the vitamins, minerals, and other nutrients it needs. After about nine months inside its mother, the baby pushes down the birth canal and comes out into the world!

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How does air get into your lungs?

THE HUMAN BODY

1. Through your veins
2. Through your trachea
3. Through your esophagus

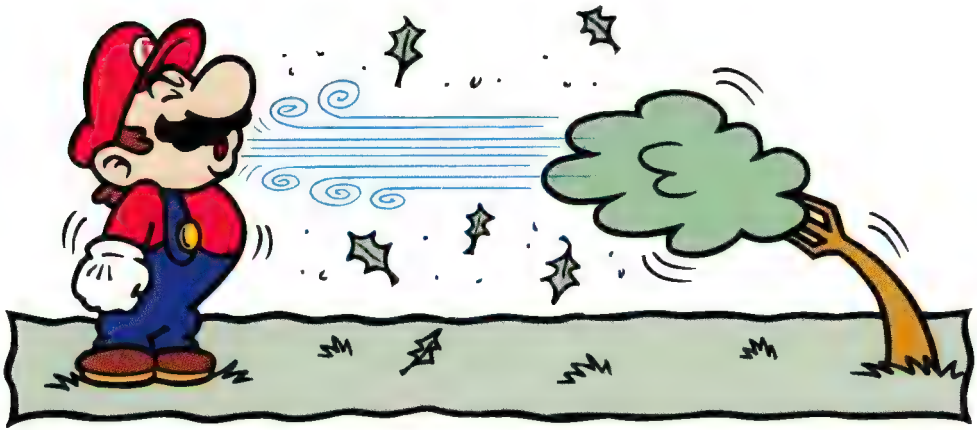

Illustration: Gary Fields

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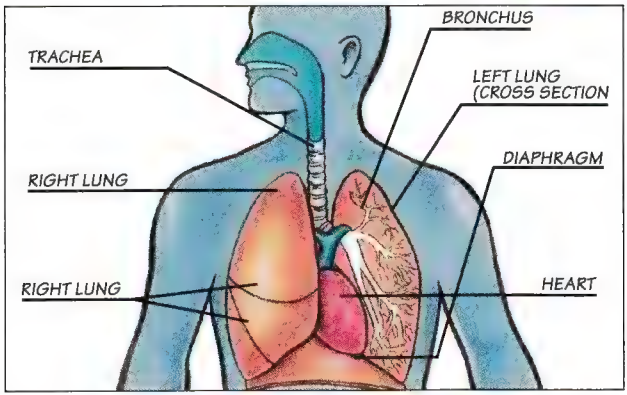
Lungs

The main function of the lungs is to exchange gases. As blood flows through your lungs, it picks up oxygen and expels carbon dioxide, a waste product.

2 Air gets into your lungs through your trachea.



© Y. Tabanés

The blood passes through the lungs to absorb oxygen when you inhale and to expel carbon dioxide when you exhale.

When you inhale through your nose or mouth, the air enters the trachea, or windpipe, in your throat. At its base the trachea branches into two smaller tubes called bronchi, which lead to the lungs.

Lung Structure

Your lungs, which hang in your ribcage from about the first rib to the diaphragm, a muscle sheet separating your chest cavity from your stomach. A thin tough layer of tissue covers each lung. Your lungs have a spongy texture and are filled with tiny air sacs, where gas exchange takes place.

Inhaling and Exhaling

Fresh air is inhaled when your diaphragm and the muscles between your ribs draw together, causing your lungs to expand. This creates a vacuum in your lungs and fresh air flows in. When you exhale, your muscles relax, your lungs contract, and carbon dioxide gas flows out.

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Which is secreted by the liver?

THE HUMAN BODY

1 Bile
2 Saliva
3 Pus

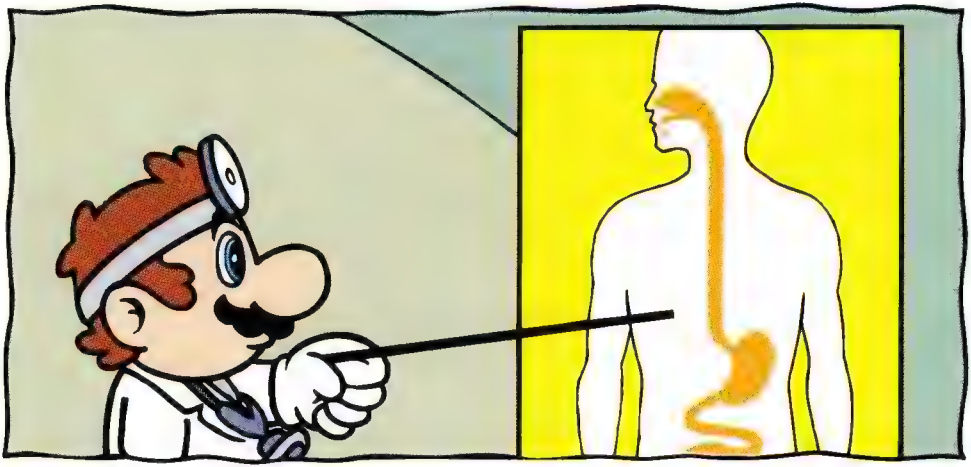

Illustration: Gary Fields

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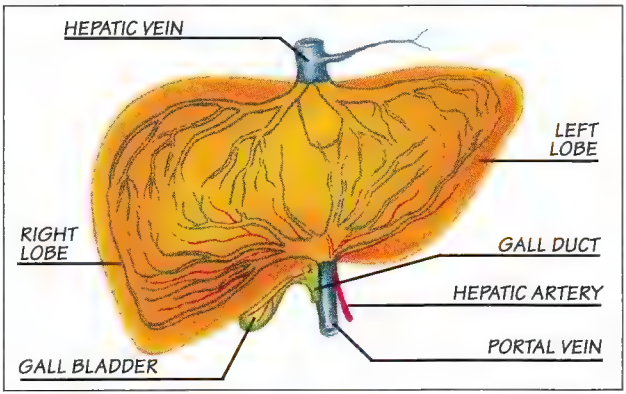
Liver

The liver is the largest organ in the body. It's located in the upper right of the abdomen, above the stomach and intestines.

1 **The liver secretes bile, which breaks down fat in the digestive process.**



© Y. Tabanes

Diagram of the liver.

When you eat, food travels from your mouth, down the esophagus to your stomach, then to the small intestine. At each step food particles are broken down chemically so that your body can absorb the nutrients. This process is called digestion. The liver secretes bile into the small intestine. Bile breaks down fats in food.

Natural Factory

The liver has several other functions, too. It stores vitamins A, D, E, and K for your body to absorb over time. It also filters harmful substances from your blood, like toxic chemicals, such as pesticides, you might inhale or swallow. It's like a busy chemical factory inside your body.

Care and Feeding

Because the liver performs so many vital functions, liver disease can be serious. To keep your liver healthy, limit the fatty foods you eat and stay away from harmful substances, like alcohol.

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Why do pregnant women have ultrasound tests?

THE HUMAN BODY

1. To test their hearing
2. To ensure that their babies are healthy
3. So that the babies can listen to music

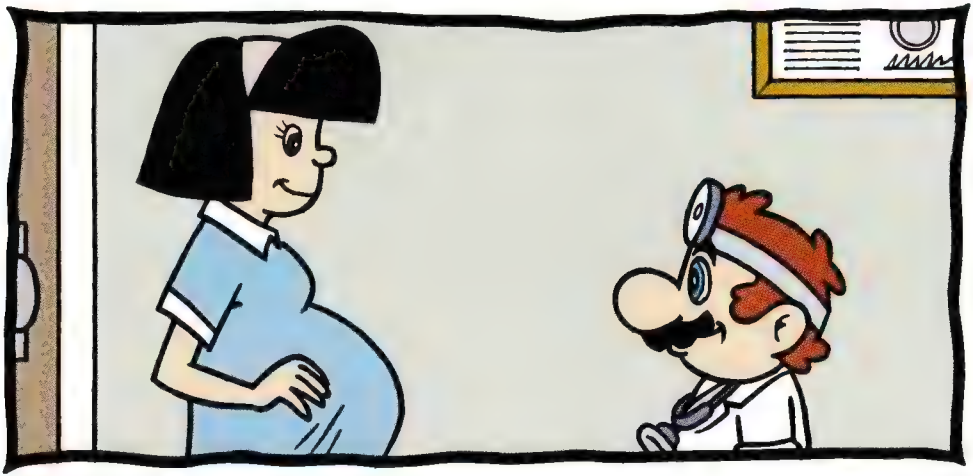

Illustration: Gary Fields

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Ultrasound

In medicine, ultrasound is the use of ultrasonic waves for diagnostic or therapeutic purposes. Ultrasound allows doctors to see an internal body structure or generate localized deep heat to the tissues.

2 To ensure that their babies are healthy.

© P. Kennedy / Hoaqui

Pregnant mothers are often reassured when they hear their baby's heartbeat and see its shape on the screen of an ultrasound machine.

Ultrasound testing uses high-frequency sound waves to produce the images of interior parts of the human body. Ultrasonic waves are sounds that cannot be heard by humans but which, when they travel through the body, are reflected back anywhere there is a change on thickness, or density. These reflected sounds are projected onto a screen as pictures.

Baby-to-Be

The purpose of using ultrasound on a pregnant woman is to is to monitor the development of the baby's body and internal organs. Because the ultrasound machine is so sensitive, it can pick up on abnormal fetal movement or heartbeats early in a pregnancy. This makes it possible for doctors to intervene and remedy any problems before they become more serious.

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Are hair and eye color hereditary?

THE HUMAN BODY

1 Yes

2 No

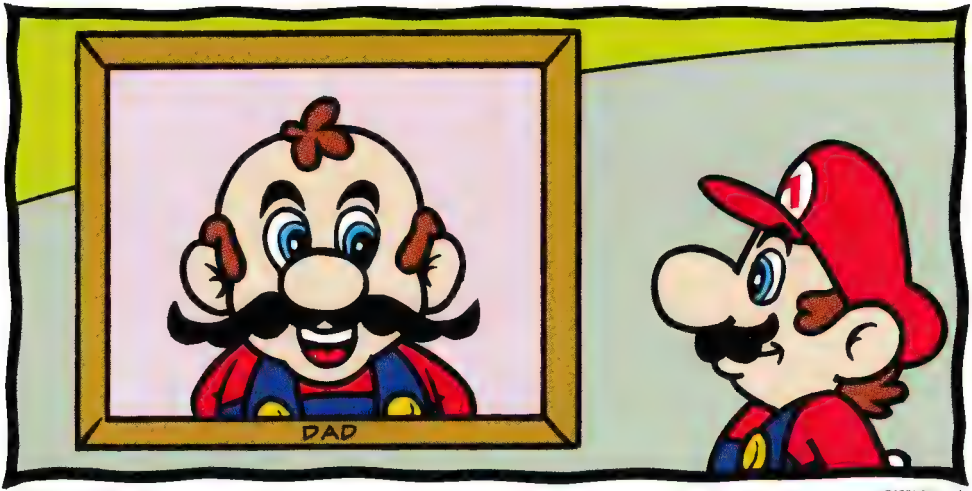

Illustration Gary Fields

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Heredity

Your physical characteristics, such as hair color and eye color, are determined by your parents' characteristics. This biological transfer of traits from one generation to another is called heredity.

1 Yes, hair and eye color are hereditary.

© R. Taylor / Hoaqui

Although many babies look like their parents, they can just as well inherit traits from past generations.

Inside every person are molecules called genes which are like blueprints of our physical characteristics. In a way, our genes contain a sort of biological "formula" for all the traits that make you you. When a baby is conceived, the genes of its father and mother mesh together to create a new gene that combines the mother's physical traits with the father's physical traits. This is how you can have eyes like your mother's and a nose shaped like your father's.

Family Resemblance

Your parents aren't the only ones who influence your genes. You can also inherit physical characteristics from other family members. The red-haired son of two brown-haired parents might have inherited his hair color from a grandparent. Other biological traits ar passed on as well. Some diseases such as diabetes, are hereditary.

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What produces the sound of the human voice?

THE HUMAN BODY

1. Sinuses
2. Vocal cords
3. Tonsils

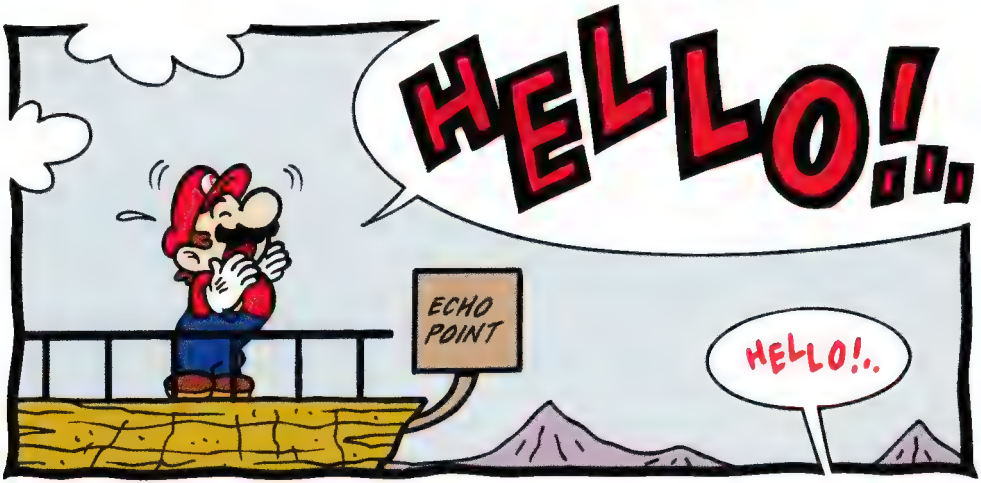


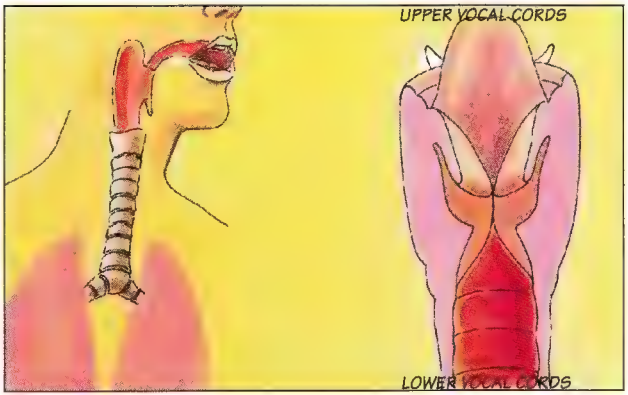
Illustration: Gary Fields

©1995 Nintendo

Voice

The voice is created by the vibration of the vocal cords in contact with air. These vibrations pass through the larynx and the mouth, giving each voice its unique sound.

2 **The sounds of our voices are produced by the contact of air with the vocal cords.**



© Y. Tabarés

The human voice is capable of complex systems of sound. Some African languages contain "clicks" made by stopping the flow of air from the larynx.

The human voice is produced by vocal cords in the larynx, a hollow tube of cartilage and muscle connected to the trachea, or windpipe. When we inhale—breathe in air—it causes a vibration, which passes up through the larynx and into the mouth, emerging as a voice.

Human Voice

The structure of the human vocal tract is unique in nature. Because of the epiglottis, a small flap at the top of the larynx, we can close the vocal tract off from the respiratory, or breathing, tract. If the epiglottis doesn't close completely, it can cause problems, such as when a person is eating and talking at the same time and suddenly finds it impossible to do either. But most of the time, an epiglottis helps us to make the sounds involved in speech, which are more complex than the sounds made by other animals.

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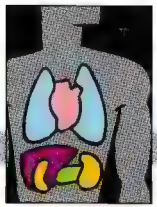
Do women live longer than men?



THE HUMAN BODY

1 Yes, women generally live longer than men.

2 No, men generally live longer than women.

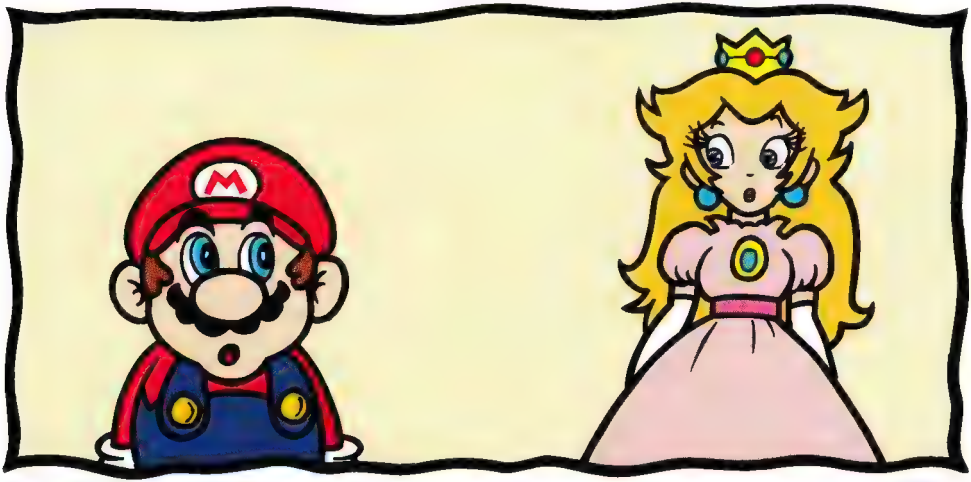


Illustration Gary Fields

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Longevity

We can only estimate longevity—how long we might live. Although we know that women generally outlive men, factors such as heredity, health care, and life events affect longevity.

1 Yes, women generally live longer than men.

© Len Sirman

"Older is wiser" says the proverb. Some societies honor the elderly for their wisdom and experience.

The average life span for humans is 70 years.

A Long Life

Eating a healthy diet, getting plenty of exercise and sleep, and reducing unhealthy stress all contribute to a person's longevity. However, there are other factors as well. If your parents and grandparents lived long lives, you probably will, too. Good health care, minimal exposure to diseases and absence of genetic abnormalities are all factors, as are life events, such as war or famine. Where you live is important, too. People who live in heavily polluted areas can develop illnesses that shorten their lives. In countries with poor medical care, people also tend to die at a younger age. On the other hand, in some places where conditions are right, people regularly live more than 100 years.

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How many vertebrae are in the human spinal column?

THE HUMAN BODY

1. 12-17
2. 24-29
3. 32-37

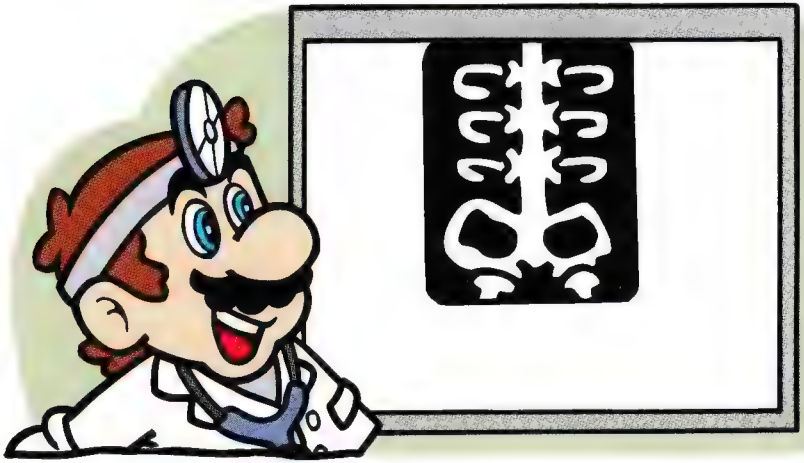

Illustration Gary Fields

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Spinal Column

The spinal column, also called the spine, vertebral column or backbone, protects the spinal cord. It is bony, but it is also flexible to permit movement.

3 There are from 32-37 vertebrae in the human spinal column.

© Len Sirman

This is an X-ray of the base of the spinal column.

The spinal column is made up of a series of small bones and cartilage, called vertebrae. Run your hand down the center of your back and you can feel the bumps of the vertebrae through your skin. There is a cushion of cartilage between each of these vertebrae. Because the spinal column is segmented and not solid like your femur or thigh bone, it allows you to bend and stretch. It also helps you stand up straight. Without your spinal column, your body would just flop over.

Great Protector

Inside the bony covering of the spinal column each vertebrae has an opening which forms a pathway down the length of the spinal column. This pathway is where the spinal cord is located.. The spinal cord is part of the nervous system, connected to the brain. It carries impulses from your brain to your body and back again.

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How many quarts of blood are in the human body?

THE HUMAN BODY

1. Approximately three
2. Approximately four
3. Approximately five

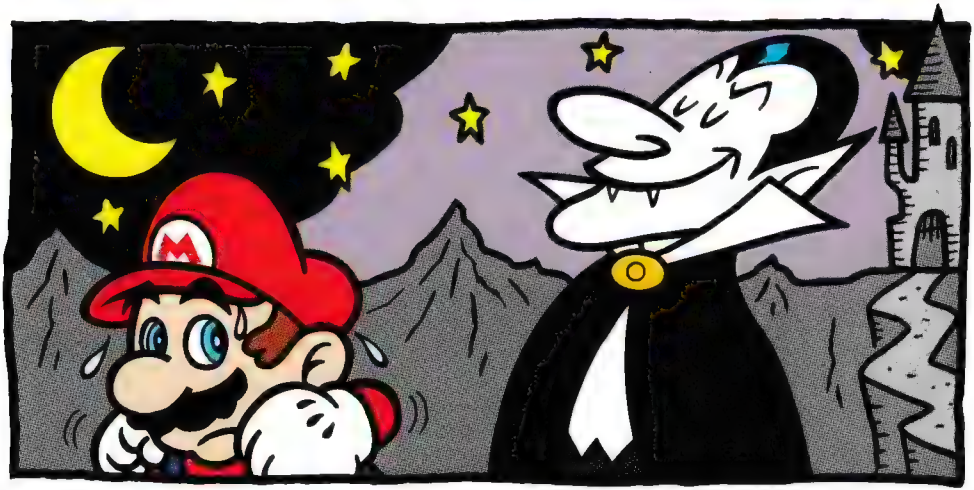


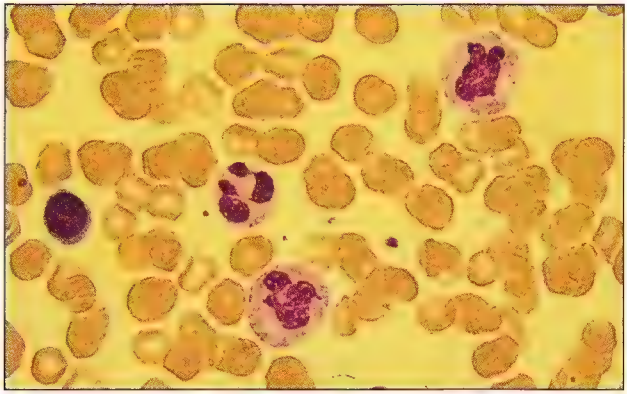
Illustration: Gary Fields

©1996 Nintendo

Blood

Blood is composed of cells and plasma. It carries oxygen, nutrients, and waste materials through the body.

3 **An 175 lb. man has approximately five quarts of blood.**



© Briolle / Rapho

This is a view of plasma under the microscope. We can see that it is composed of liquid, serum, and fibrinogen. Fibrinogen helps blood clot.

Blood may look like a simple red fluid, but it is actually quite complex. It is composed of three kinds of cells—red cells, white cells, and platelets. Each has an important job to do. Red blood cells carry oxygen from our lungs to our tissues, and carry waste products away. White blood cells protect us from foreign bodies. Platelets help us to stop bleeding by forming clots. Blood also contains plasma, which is mostly water. Plasma carries substances that our bodies need to function properly, including antibodies—proteins which fight harmful substances.

What is Your Type?

Blood and fluids other than those in body cells make up about one-fifth of our body weight. Everyone has one of four blood types—A, AB, B or O. The letters refer to proteins in the blood. When a person receives a blood transfusion, it is crucial that the blood he receive match his blood type. Different blood types don't usually blend successfully.

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Which organ is responsible for pumping blood through our veins?

THE HUMAN BODY

1 The brain

2 The heart

3 The kidneys

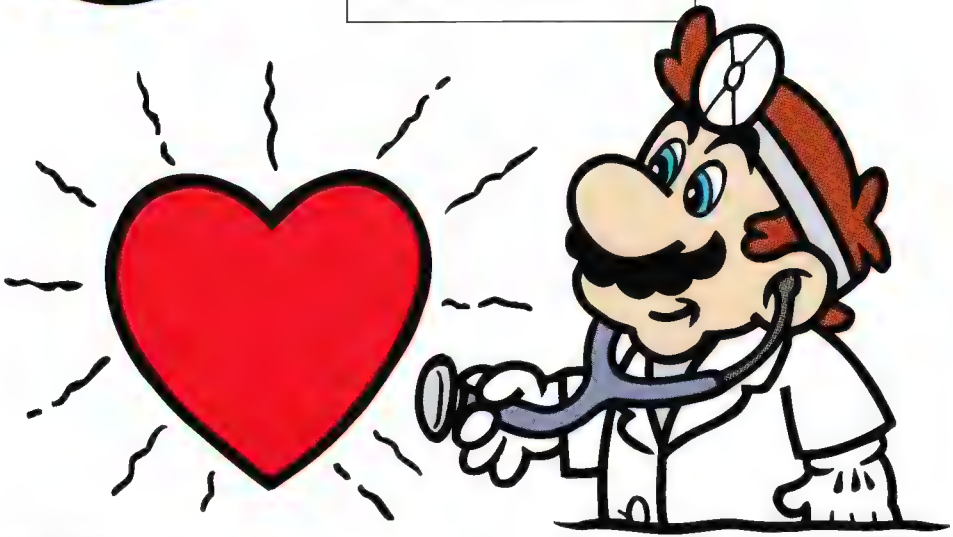

Illustration. Gary Fields

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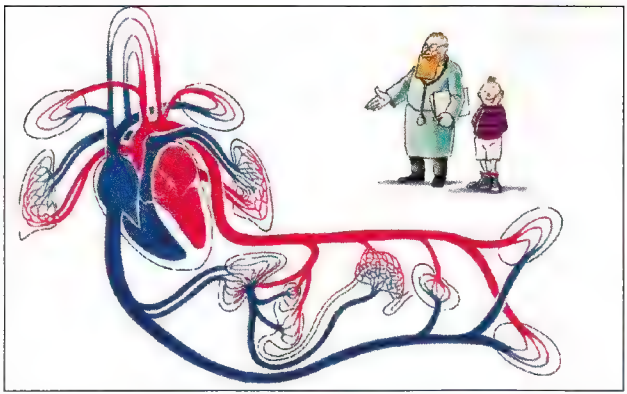
Circulation

Internal electrical impulses cause our heart muscle to rhythmically contract and relax, thus pumping oxygenated blood through our bodies.

We think of the heart as the center of our emotions. We have a broken heart, a happy heart or even express our heartfelt thanks. These images are vivid and expressive. But your doctor will tell you that your heart is actually a biological pump—a fist-sized muscle designed to pump blood to the rest of the body. In fact, in a resting adult, the heart beats or pumps about 70 times per minute!

2 The heart is responsible for pumping blood through our veins.



© Y Tabarés

Veins (shown in blue) carry blood back to the heart. Arteries (shown in red) carry blood away from the heart.

Your heart receives blood from the rest of the body and sends it to the lungs to be oxygenated. Then the blood goes back to the heart to be pumped out again into the body. This is called circulation.

Lub Dub

Your doctor listens to your heart with a stethoscope ("stetho-" is from a Greek word meaning "chest"). By listening to the sounds of your heart working, problems can be detected. A healthy heart beats with a two-part "lub-dub" sound.

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What is the olfactory sense?

THE HUMAN BODY

1. Smell
2. Hearing
3. Touch

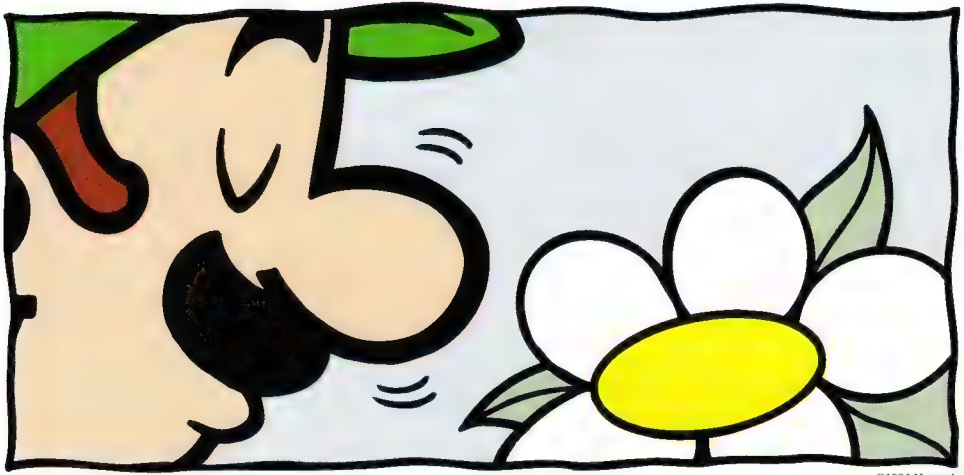

Illustration: Gary Fields

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Olfactory Receptors

Olfactory receptor cells, located in the nasal cavity, detect odors. How well we detect odors is influenced by many things: humidity, health, or even hunger.

1 The olfactory sense is the sense of smell.

© Len Sirman

Although air carries odors into both our noses and our throats, only the nose can distinguish them.

Animals use their sense of smell to distinguish their enemies from their friends. Your dog recognizes your scent before he sees you. But while insects can smell with their antennae and their mouths, humans have only their noses (with their olfactory receptors) to detect odors. "Olfactory" comes from the Latin for "smell" plus "make."

There are six major categories of odor: fruity, flowery, resinous, spicy, foul, and burned. Odors are always airborne. When the molecules reach our noses, electrical activity transmits information from our noses to our brains, and we identify what we smell. Smell may be affected by temperature, hunger, humidity, hormones, illness, or other factors. You cannot taste food when you have a cold because smell is an essential element of taste. You need both your taste buds and your nose in order to taste and enjoy food.

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Why is it important to know your blood type?

THE HUMAN BODY

1. For identification purposes
2. For blood transfusions
3. For nutritional purposes

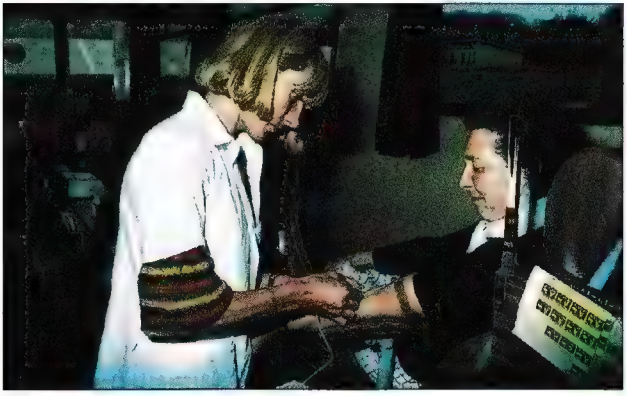
Illustration: Gary Fields

©1996 Nintendo

Blood Type

Red blood cells can contain zero, one or two antigens—substances that can create antibodies, which protect against infection.

2 **It is important to know your blood type in case you want to give blood or need to receive a transfusion.**



© Ph. Delabre / Explorer

By giving blood, you can save the life of someone who needs it.

Blood is typed A or B according to the antigen it contains. If the blood contains both, it is type AB, and if it has none, it is type O (the most common blood type). Different blood types aren't always compatible. A person with type A cannot donate to or receive blood from a person with type B, for example. However, a person with blood type O is a "universal donor," which means that he or she can donate blood to any type. And a person with type AB is a universal recipient, able to accept transfusions of any type.

What's Your Type?

You inherit your blood type from your parents. If both of them are type O, you probably are type O, too. Your doctor can perform a simple test to determine your blood type.

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How are earaches caused?

THE HUMAN BODY

1. By listening to loud music
2. From viral or bacterial infections
3. From sleeping on a dirty pillow

Illustration, Gary Fields

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Earache

Earaches may also be caused by an allergy of the middle ear. They are some of the most common infections in childhood. Typically an earache is accompanied by fever.

2 Viral or bacterial infections are typical causes of earaches.

© Ed Simpson / TSW-Los Angeles, Ltd.

Earaches can be painful, but there are usually no lasting complications.

Allergies and viral and bacterial infections cause the lining of the middle ear to become inflamed and painful. Earaches due to allergies usually go away when the substance to which the person is allergic is removed.

Treatment

To diagnose the cause of an earache, doctors carefully examine the tympanic membrane, often called the eardrum, to determine if fluid has collected behind it, contributing to the pain. In the case of bacterial infections, an antibiotic may be prescribed. There are usually no lasting effects of an earache, however the problem can be complicated if the eardrum becomes perforated or punctured. In rare cases, there may be permanent hearing loss.

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How much does a human brain weigh?

THE HUMAN BODY

1. 1.5 pounds (0.65 kg)
2. 3 pounds (1.3 kg)
3. 6 pounds (2.6 kg)

Illustration: Gary Fields

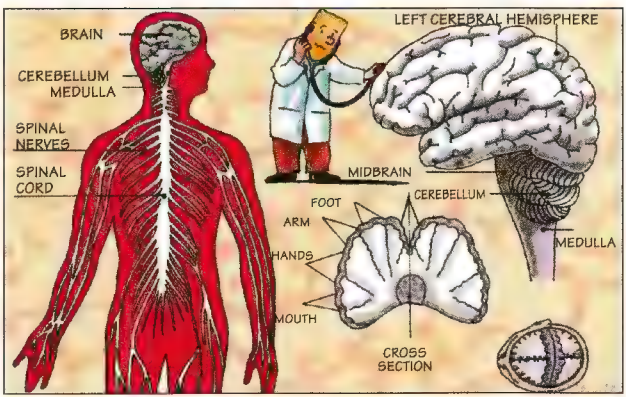
©1996 Nintendo

Brain

The brain is made up of about 10 billion interconnected nerve cells. It also contains glial cells (supporting cells), blood vessels, and secretory organs.

A part of the central nervous system, the brain controls all your body's basic functions, like respiration and blood circulation. It's also your memory bank, storing everything you learn—from addition to riding a bicycle—so you can use it again. Your brain also stores emotions. It receives and interprets the messages your body gets from the external environment and tells your body how to react.

2 **The human brain weighs about 3 pounds (1.3 kg).**



© Y Tabarés

The three main parts of the brain are the cerebrum, cerebellum, and brain stem. The largest is the cerebrum, which accounts for nearly 85 percent of the brain's weight.

Brain Map

Specific areas of the brain are responsible for each sense: sight, smell, hearing, taste, and touch. Another area controls language and speech. Named Broca's area, it is in charge of the mouth and throat movements we make when talking. Yet another area allows us to understand what we read and hear. A large area of the human brain is responsible for awareness, intelligence, and memory.

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What is a neuron?

THE HUMAN BODY

1. A cell that conducts messages through the nervous system
2. Part of the eye that detects color
3. One of the bones of the neck

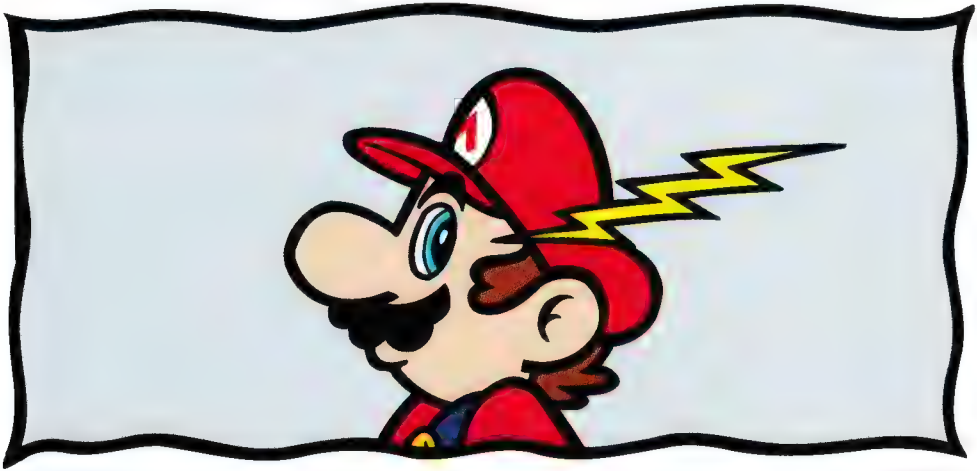

Illustration: Gary Fields

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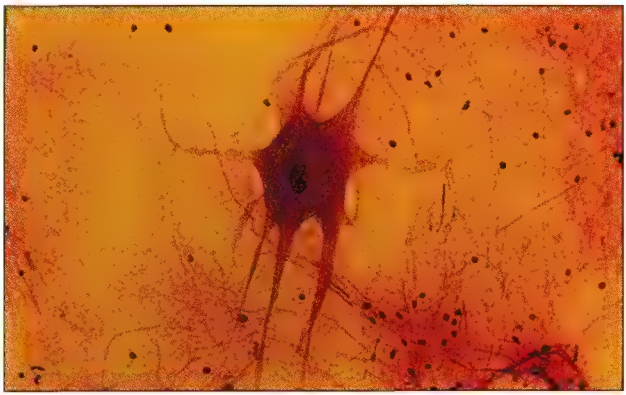
Neurons

Neurons gather bits of information, or stimuli, from the environment and send them to the brain. The brain processes this information and sends a message back through the neurons to tell the body how to react.

1 Neurons are cells that transfer messages, called impulses, through the nervous system.



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There is estimated to be over 100 billion neurons, such as this motor neuron, in the human nervous system.

The human nervous system consists of two linked parts. The central nervous system includes the brain and spinal cord, while the peripheral nervous system is composed of all the nerve cells that transmit impulses to and from the central nervous system.

Three Nerve Cells

There are three types of nerve cells, or neurons: Sensory neurons pass along information related to taste, touch, hearing, sight, and smell. Motor neurons send information to certain muscles. Interneurons relay impulses between sensory and motor neurons. Each neuron has a central portion, the cell body, which contains the cell's nucleus. Extending from the cell body are short dendrites, the receptors of stimuli. Another extension, the axon, transmits nerve impulses from cell to cell.

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What part of the body is used in digestion?

THE HUMAN BODY

1. Esophagus
2. Rib cage
3. Femur

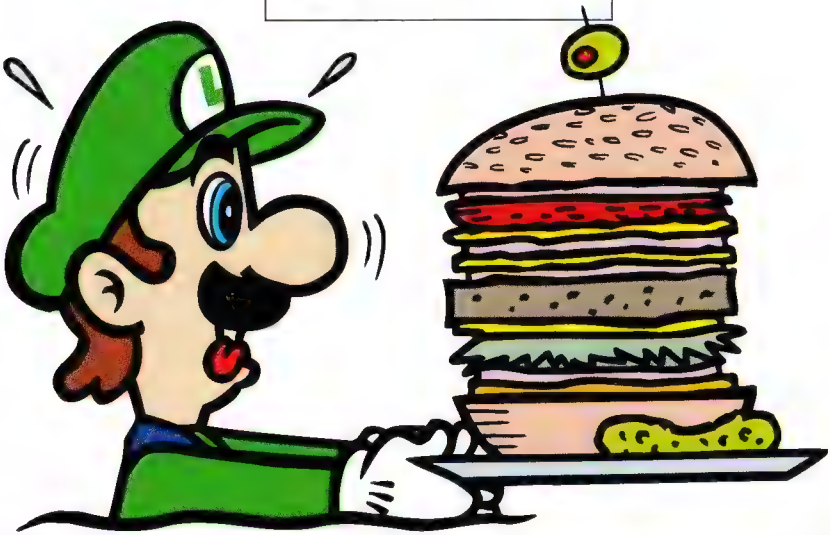

Illustration: Gary Fields

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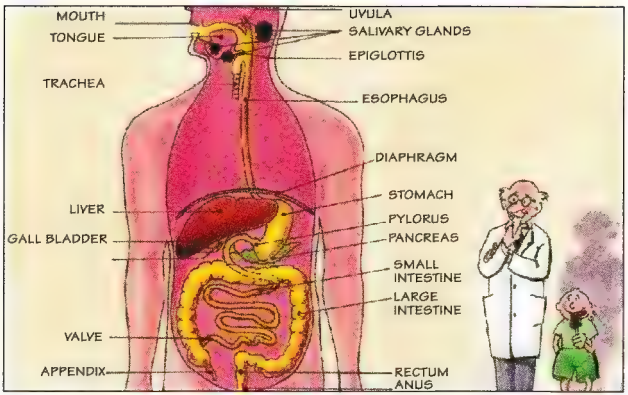
Digestive System

Our body needs energy to function. Our digestive system, a continuous path from the mouth to the anus, breaks down food and transforms it into energy.

1 The esophagus is part of the human digestive system.



The human digestive system is a continuous path.

There are two types of digestion: mechanical and chemical. In mechanical digestion, food is chewed up by the teeth and mixed with saliva to further break it down and make it easier to swallow. The chewed-up food is swallowed and passes through the esophagus to the stomach. There, chemical digestion begins when strong acids break down the food even further.

Intestinal Journey

After the food leaves the stomach, it travels through the small intestine. Its nutrients pass through the small intestine's cell wall to the liver and pancreas, then into the blood to be used throughout the body.

Substances in food that the body cannot absorb pass from the small intestine to the large intestine. From there, they enter the rectum and are finally eliminated from the body through the anus.

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Where are the kidneys located?

THE HUMAN BODY

1. Behind the rib cage, next to the heart
2. At the top of the right leg
3. In the lower back, on either side of the spinal cord

Illustration: Gary Fields

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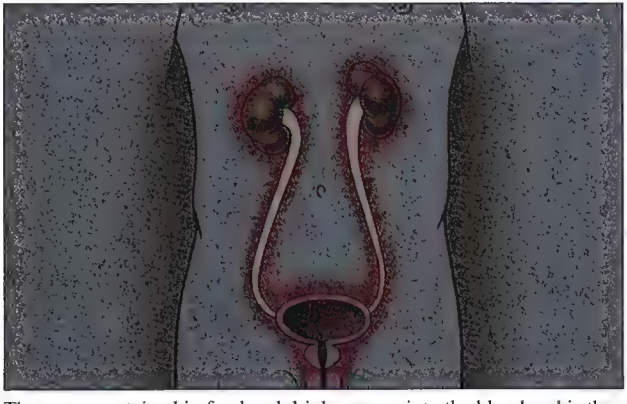
Kidneys

The kidneys are part of the excretory system. They help maintain normal blood pressure and regulate the amount of fluid and salt in the body.

3 **The kidneys are located in the lower back, on either side of the spinal cord.**



© Margie Caldwell-Gill / Custom Medical Stock Photo

The water contained in food and drinks passes into the blood and is then filtered by the kidneys. Useful elements are absorbed back into the blood, while waste is excreted as urine.

The kidneys filter and purify the blood and secrete urine. They also maintain a healthy amount of water in the body. Reddish-brown, bean-shaped organs, they are embedded in the fatty tissue of the lower back. They can filter all the water in the body's blood—an average of 5 quarts (4.7 l) of water—in 45 minutes. Some of this is excreted, while the rest is reabsorbed by the kidneys.

Waste travels from the kidneys to the bladder through tubes called ureters. The body excretes an average of 3.7 pounds (1.4 kg) of urine per day. This amount varies with the amount of water lost through perspiration or vomiting.

Kidneys maintain normal blood pressure by secreting a hormone called renin. They also aid in the production of red blood cells.

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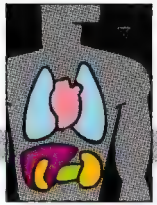
How many bones make up the human skull?



THE HUMAN BODY

1. 1
2. 8
3. 22

Illustration: Gary Fields

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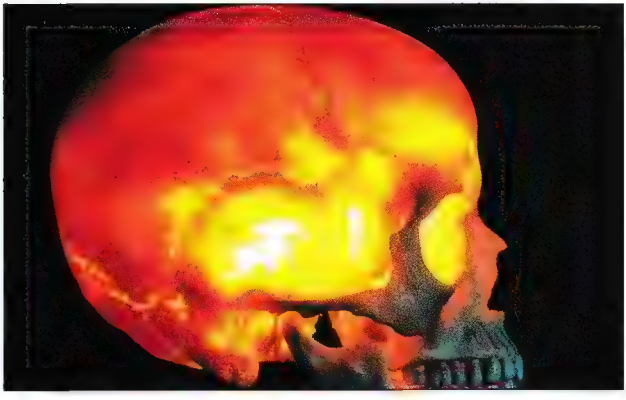
Skull

When a child is born, the bones in top of the skull are loosely connected by sutures, or joints. These bones fuse, or grow together, before a child is eighteen months old.

3 The human skull is composed of 22 bones fused together.



© Len Strman

The skull protects the brain and is an anchor for the muscles of the face and mouth.

Your skull is like a protective helmet covering your brain, eyes, ears, nose, and mouth. All vertebrates, or animals with backbones, have a skull. Simple vertebrates have skulls composed of soft cartilage that never turns to bone. In more developed vertebrates, such as humans, the cartilage of the skull hardens soon after birth.

Cranial and Facial Bones

The two main sections of the human skull are the cranial and the facial regions. The bones in the cranial region encase the brain, forming the forehead, back and top of the head, temples and cheeks. These bones are stationary, that is, they do not move.

In the facial region, two nasal bones make up the bridge—or very top—of the nose. The bottom, or pointed part of your nose is softer because it's made of cartilage, not bone. The two bones that form your jaw are hinged so that you can open and close your mouth.

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How many bones are in a human foot?

THE HUMAN BODY

1. Less than 5
2. Exactly 12
3. More than 20

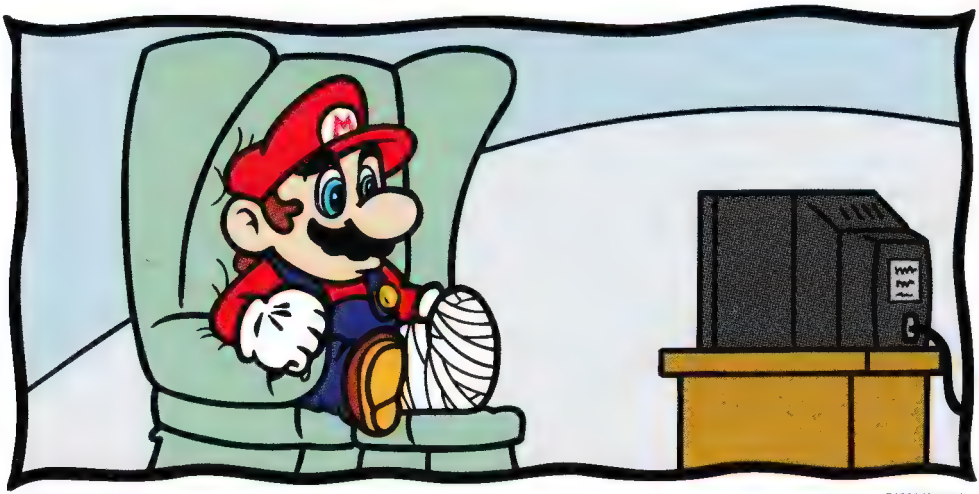

Illustration: Gary Fields

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Foot

Humans are the only mammals that walk exclusively on 2 feet as adults. Our close relatives, the apes, alternate between walking on 2 legs and using all 4.

3 Each foot contains over twenty different bones.

© Len Sirman

The soles of the feet are usually not perfectly flat. They touch the ground at their front, back, and outer edges.

Of the 206 bones that make up the human skeleton, over 20 of them are in the feet. The 2 largest bones of the foot—both in the ankle region—are the calcaneus, or heel bone, and the talus, a small bone that joins the lower leg to the calcaneus. In the middle part of the foot are five cylindrical bones, each of which are jointed to the toes.

The bones in the feet are connected to each other by strong bands of tissue called ligaments. Muscles in the legs control the movement of the feet. A thick layer of fatty tissue on the bottom of the foot provides cushioning to absorb the impact of walking and jumping.

Bones alive!

The bones in our body are living material. The outside of each bone is made of strong fibers and minerals, like calcium. Beneath this tough outside coating is the soft marrow, where millions of new blood cells are produced each day.

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What is the largest bone in the human body?

THE HUMAN BODY

1. Femur
2. Tibia
3. Humerus

Illustration, Gary Fields

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Bones

The femurs are the main support for your body weight. They are not only the longest, but also the heaviest bones in your body.

1 The femur, or thigh bone, is the largest bone in the human body.

© Gaillard / Jerrican

Bones need calcium to grow and develop properly. Calcium is found in milk and other dairy products.

Bones provide an anchoring point for your muscles. Some bones, including the ones in your arms and legs, are connected to each other by joints that allow them to move. Each femur is connected by joints to the pelvis, or hip bone, and the tibia, or shin bone.

There are several types of joints, each of which allows a different kind of movement: Pivot joints allow turning movement, such as turning the head. Ball-and-socket joints allow a wide range of movement, like the joystick on a video game. The joint between the hip and thigh bone is a ball-and-socket joint. Hinge joints, like the hinges on a door, allow limited movement. The knee is a hinge joint.

Healing Broken Bones

Doctors can tell if a bone is broken by taking a picture using x-rays. To make sure that broken bones heal properly, doctors first line them up and then immobilize them with a cast or bolts. It takes about three months for a bone to heal completely.

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What are conjoined twins?

THE HUMAN BODY

1. Twins who share one or more body parts
2. Twins who practice the same religion
3. Twins with psychic abilities

Illustration: Gary Fields

©1996 Nintendo

Conjoined Twins

A human baby develops from a single egg that divides many times as the baby grows. Conjoined twins are formed when the egg doesn't divide fully into two identical twins.

1 Conjoined twins, sometimes called Siamese twins, are attached to each other by shared body parts.

© Edimédia

Conjoined twins are very rare: only one child in 50,000 is born connected to a twin. Of those twins, only 500 live past their first birthday.

Conjoined twins are usually joined along the trunk of the body or at the front, side, or back of the head. Some conjoined twins can be separated surgically. Twins joined near the base of the spine were successfully separated in 1953, as were twins joined at the skull in 1979.

Twins who share an important organ—such as the heart or lungs—are usually not separated surgically. Separation of such twins could result in the death of one or leave both with severe disabilities. No conjoined twins have been successfully separated after early childhood.

Twins in the News

Conjoined twins Chang and Eng were born in Siam (now Thailand) in 1811. They moved to the United States, became wealthy farmers, married two sisters, and parented 21 children between them.

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How many cervical vertebrae are in the human neck?

THE HUMAN BODY

1. 7
2. 12
3. 25

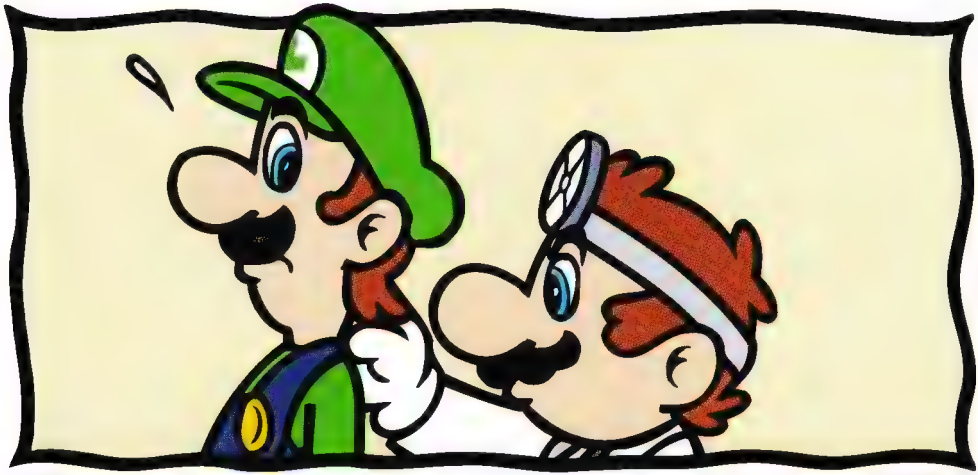

Illustration Gary Fields

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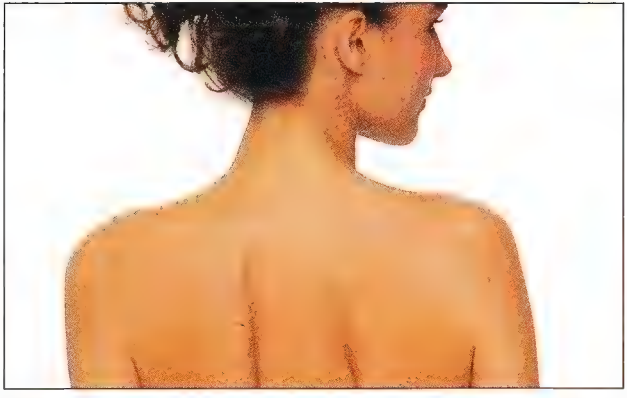
Neck

The neck joins the head to the shoulders and chest. The muscles of the neck support the head, a very heavy part of the body.

1 There are 7 cervical vertebrae in the human neck.



© Rouchon / Explorer

Humans have relatively long necks compared to the primates, our closest animal relatives.

Some of your body's most important structures pass through your neck: several major veins and arteries, the esophagus, larynx and vocal cords, several muscles, and the nerves of the spinal cord.

Spine

In humans and all other mammals, the neck is supported by vertebrae, or tiny bones that form the spine. The spine, or backbone, is the main source of support for the skeleton. The skull, ribs, and pelvis, along with many muscles and ligaments, are attached to the spine. The spine also surrounds and protects the spinal cord.

There are 7 vertebrae in the neck, 12 in the thorax, and 5 in the lower back. The backbone is attached to the pelvis by 5 fused vertebrae. The coccyx, or tailbone, is made up of 3 to 5 fused vertebrae. Pads of cartilage called intervertebral disks separate the vertebrae and keep them from scraping together.

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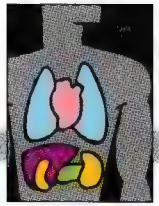
Do identical twins have identical fingerprints?



THE HUMAN BODY

1. Yes, because identical twins are exactly the same.
2. No, because everyone's fingerprints are unique.

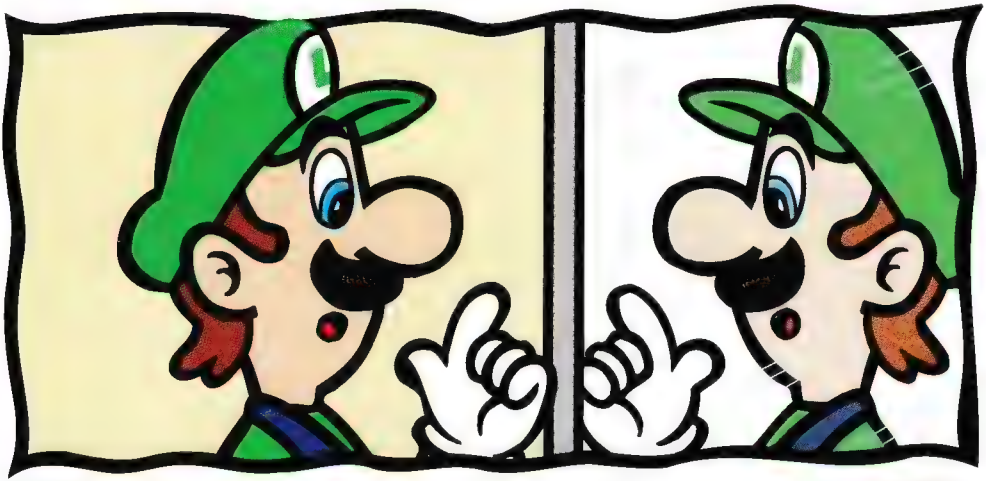


Illustration: Gary Fields

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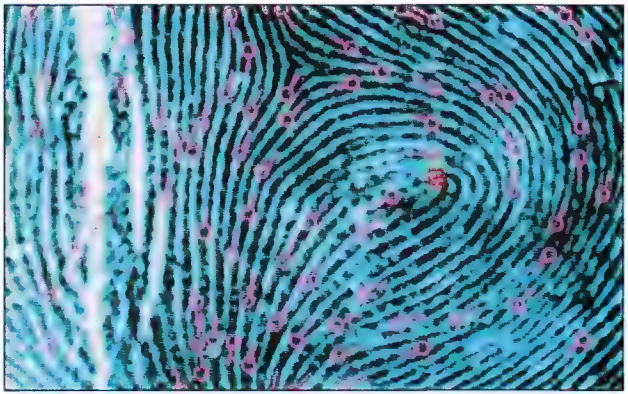
Fingerprinting

Fingerprinting is a method of identification. It is based on the impression made by the tiny ridges on the underside of each finger.

2 Twins do not have identical fingerprints; each person's fingerprints are unique.



© Len Simnan

Unique patterns of arches, loops, and whorls distinguish one person's fingerprints from another's. Fingerprint identification cards are filed by ridge pattern.

In the early 1800s, Czech physiologist Johannes Evangelista Purkinje devised a system of fingerprint classification. Late in the 19th century, British anthropologist Sir Francis Galton proposed a more detailed classification system.

Criminal Identification

Sir Edward Richard Henry, a British police officer working in Bengal, India in the late 19th century, was the first to suggest using fingerprints to identify criminals. The use of fingerprints in criminal identification quickly spread throughout Europe and the U.S.

When a person touches any smooth, hard surface, oils in the skin are left behind as fingerprints. At a crime scene surfaces are dusted with a powder that adheres to those oils. The prints are then photographed or otherwise preserved so that they may be compared with the fingerprint records of suspected criminals.

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What causes nightmares?

THE HUMAN BODY

1. Obesity
2. Worries and stress
3. Too much exercise

Illustration Gary Fields

©1996 Nintendo

Nightmares

Nightmares are unpleasant dreams. They usually occur when a person is worried or unhappy about something in daily life.

2 Nightmares can be caused by worries and stress.

© Visuals Unlimited

Modern research techniques such as this test, which monitors a sleeping woman's brain waves, increase our knowledge and understanding of sleep.

Everyone has nightmares—dreams that frighten them. Psychologists who study dreams believe nightmares might be caused by the things that trouble you during waking hours. Fighting with your best friend, losing your wallet, or failing a test are upsetting occurrences. Sometimes your brain can't let go of the worry, even when you're asleep. Carry-over from waking thought to dreams is called the continuity principle or day residue, because worries from the day continue at night. Nightmares also might be triggered by other disruptions, such as sleeping in an unfamiliar bed, being awakened by thunder, or eating spicy food.

Dream Images

Nightmares can be specific. If your dog runs away, you might have a nightmare about searching for him. At other times, nightmares are made up of images and feelings. It's common for people to have nightmares about falling from a great height or being chased by someone (or something!) evil.

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What is colored part of the eye called?

THE HUMAN BODY

1. Iris
2. Petunia
3. Rainbow

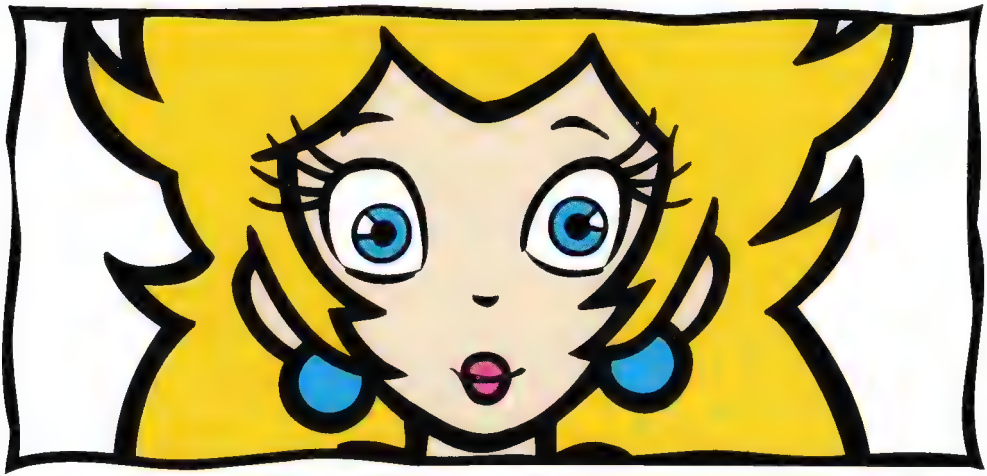


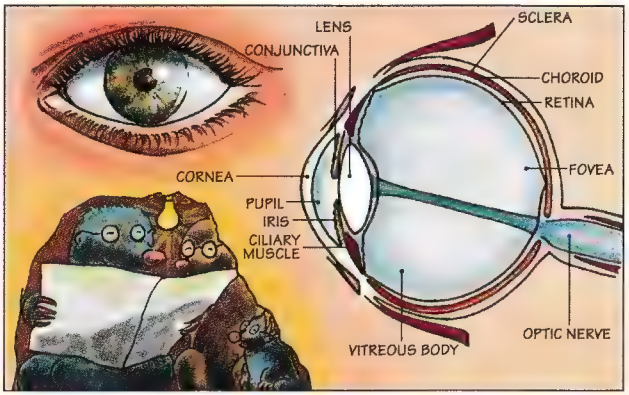
Illustration Gary Fields

©1996 Nintendo

Eye

The eye—organ of sight—is connected to the brain by the optic nerve.

1 The colored part of the eye is called the iris.



© Y Tabarés

This drawing shows the parts of the eye. Light enters the eye through the pupil and travels through the lens and the vitreous body to the retina, which sends sensory impulses through the optic nerve to the brain.

The eye has three layers. The outer layer, called the cornea, protects the delicate tissues behind it. A constant flow of tears keeps the cornea moist and keeps foreign objects, like dust, from sticking to it. The second layer contains the pupil, iris and lens. The pupil—the black spot in the center of the eye—is a hole that allows light to enter the eye. Surrounding the pupil is the iris—the colored part of the eye. This muscle opens and closes the pupil, regulating the flow of light. In the dark, the pupil dilates, or opens, to let in as much light as possible. In bright sun, it contracts, or grows smaller.

How We See

Light passes through the two outer layers to the retina on the eye's back wall. The retina is covered with bodies called rods and cones which pick up impulses from the light. Rods are for dim light vision. Cones are for color vision. They send the impulses to the optic nerve, which sends them to the brain where they're translated into visual sensations.

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Why do we measure blood pressure?

THE HUMAN BODY

1. To test our strength
2. To monitor blood flow
3. To count platelets

Illustration: Gary Fields

©1996 Nintendo

Blood Pressure

Weird word: The instrument a doctor uses to measure blood pressure is called a sphygmomanometer.

2 We measure blood pressure to monitor blood flow.

© Len Sirman

A doctor measures blood pressure when the heart is pumping and resting. Normal blood pressure is 120/80 (pumping over resting). It is measured in millimeters of mercury (mm Hg), based on how high the mercury rises in the sphygmomanometer, or blood pressure gauge.

A doctor tests blood pressure to find out how well the heart pumps blood through the arteries. Blood pressure depends on how much blood the heart pumps and the diameter of the arteries the blood flows through. When the arteries are clear, blood flows easily. If they become clogged with fatty deposits the path for the blood is narrower. This raises blood pressure because the heart has to work harder to pump the same amount of blood through the blood vessels.

Keep Your Heart Healthy

Kids with healthy hearts usually have normal blood pressure, but many adults—especially those who don't exercise and who eat lots of fatty foods—suffer from high blood pressure. This is dangerous because it puts extra pressure on the heart, which can lead to heart disease and other physical problems. People can lower their risk of high blood pressure, by eating low-fat foods and exercising regularly.

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Why do people snore?

THE HUMAN BODY

1. To exercise their vocal cords
2. Because they're in R.E.M. sleep
3. Because they're having trouble breathing

Illustration, Gary Fields

©1996 Nintendo

Snoring

It's a fact that men are more likely than women to be snorers.

3 People generally snore because they have trouble breathing.

© Labat / Jerrican

Snoring occurs when air passages in the throat become blocked, making it hard to breathe. Shifting position sometimes makes snoring stop.

Do you snore? It's hard to judge for yourself since people only snore when they're fast asleep. Sometimes they actually snore loud enough to wake themselves up! Snoring is annoying, but it's not usually a serious condition. It happens because the air passages in the nose and throat become blocked, making breathing difficult.

When you're asleep, your muscles are relaxed. This includes the muscles in your throat and tongue. Sometimes these muscles become a little too relaxed and they partially block air passages. Snoring is the sound the air makes as it tries to push its way down to the lungs.

Peace and Quiet

Shifting position can make a person stop snoring. People tend to snore loudest when they sleep on their backs. Sleeping on your side is the best way to prevent snoring. Colds and allergies that clog up nasal passages sometimes lead to snoring, even in people who don't usually snore. Once the cold or allergy is gone, the snoring usually stops.

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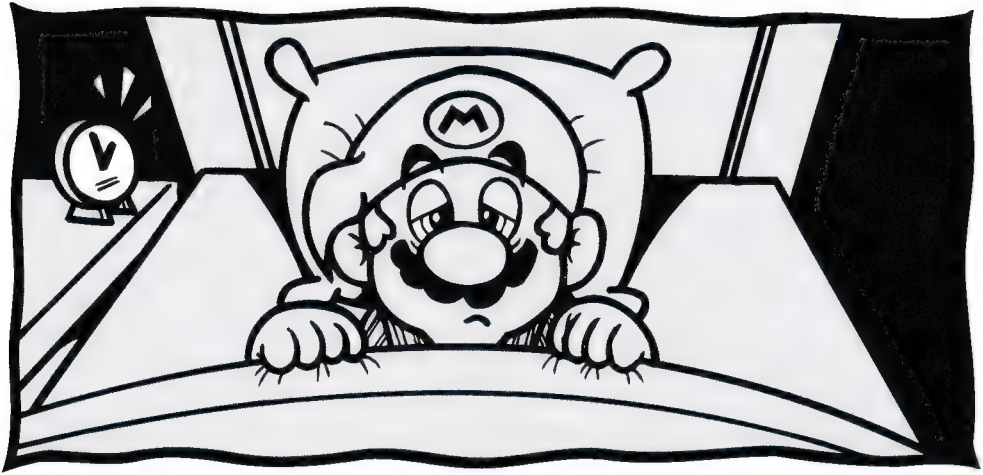
What is insomnia?

THE HUMAN BODY

1. A type of herb
2. Difficulty in sleeping
3. The study of salt



Illustration, Gary Fields

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Insomnia

Most people need about 6 1/2 hours of sleep each night. People with insomnia have trouble getting all the sleep they need.

2 Insomnia is a condition in which a person has difficulty falling asleep.

© Labat / Jerrican

People with insomnia have trouble falling asleep at night. Drinking a glass of milk or taking a warm bath before bedtime can help them relax so they can fall asleep.

Everyone has trouble sleeping sometimes. It's tough to fall asleep when you're nervous or excited, for example. But people who have insomnia have trouble sleeping almost every night. Usually, insomnia occurs when a person is worried or upset for an extended period of time. In some cases, he might have trouble falling asleep. In other cases, he might wake up frequently during the night.

Doctors may treat insomnia with drugs, but most prefer to change the person's habits and sleep routine. A doctor might tell a person with insomnia to stay awake as long as he can so that he's really sleepy when he gets into bed. People with insomnia shouldn't do work, exercise, or watch scary movies before bed. The good news is that insomnia is not a permanent condition. Eventually, the body just demands to sleep, and the person can get a good night's rest.

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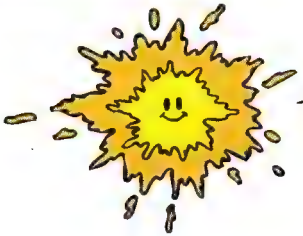
How much saliva does your body produce in a day?

THE HUMAN BODY



1. About 1 1/2 quarts (1.5 l)
2. About a gallon (3.8 l)
3. About 1 1/2 gallons (11.4 l)

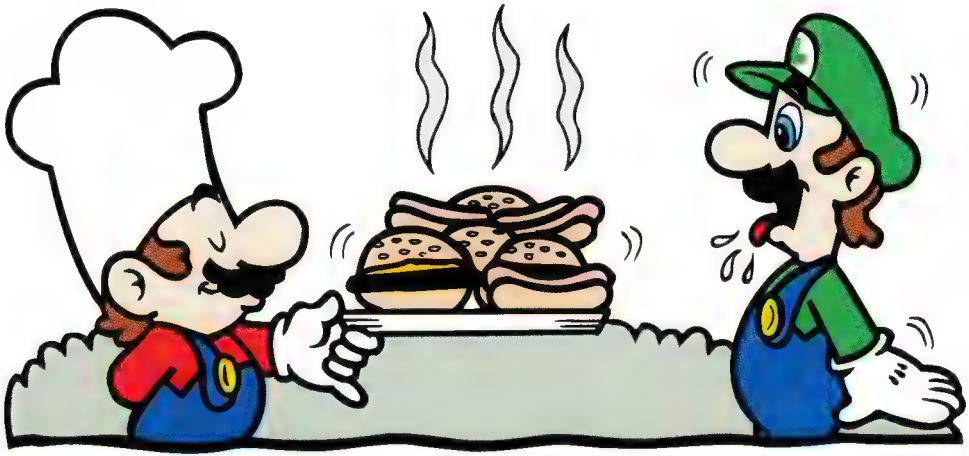


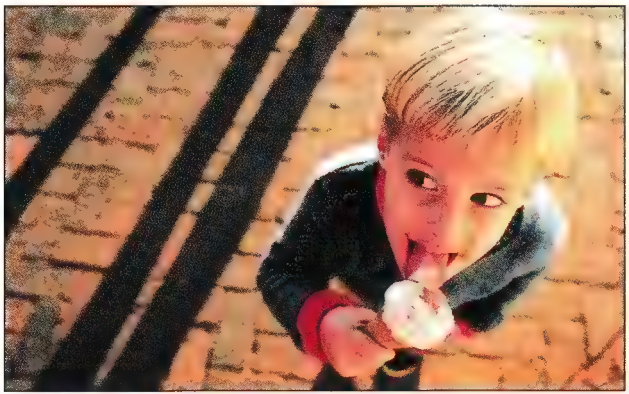
Illustration Gary Fields

©1996 Nintendo

Saliva

Your body produces 1,500 milliliters, or about 1½ quarts of saliva in a day. Saliva helps you digest the food you eat.

1 Your body produces about 1½ quarts (1.5 l) of saliva in one day.



© McIntyre / P. Reseau / Explorer

The salivary glands in your mouth produce and secrete saliva. At rest, they secrete about 0.2 milliliters per minute. When you eat, salivary glands secrete as much as 4 milliliters per minute.

Run the tip of your tongue along the bottom of your mouth and you'll feel little flaps of skin. These flaps cover the ducts of your mouth's primary salivary glands, where saliva is produced. Saliva is 99.5% water, mixed with salts, enzymes and proteins which help your body digest food.

Useful Juice

Digestion begins when you chew, breaking food into small pieces that you can swallow. Saliva softens food to make it easier to chew, and it lubricates your mouth and throat to make swallowing easier. At the same time, enzymes in your saliva begin to act on the starches in the food, breaking them down into simple sugars which your body uses for energy.

Saliva has other purposes too. It keeps your tongue and gums moist so they can move freely. It also makes it easier remove bits of foreign material—like grains of sand or dirt—from the mouth.

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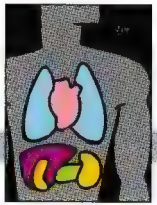
Which is the longest bone in the leg?



THE HUMAN BODY

1. Femur
2. Patella
3. Tibia

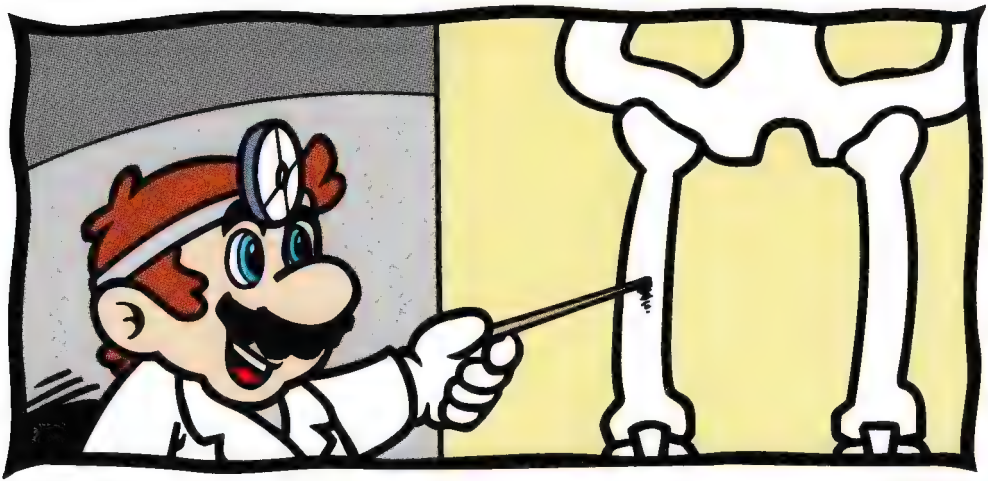


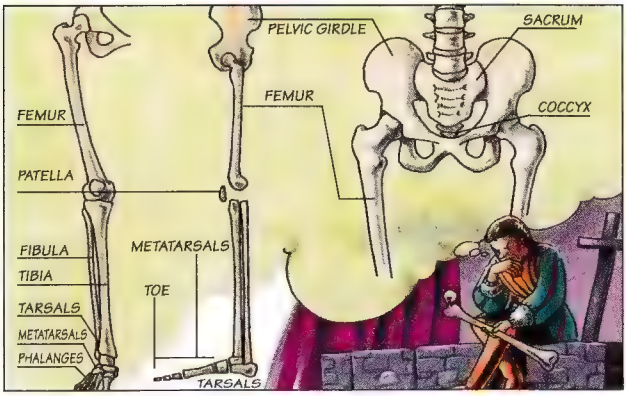
Illustration Gary Fields

©1996 Nintendo

Leg

The femur, or thigh bone, is the longest bone in the human body. It's large and strong because it bears your body's weight when you stand.

1 The longest bone in the leg is the femur, or thigh bone.



The bones of the leg.

Your leg is a marvel of biological construction because it can move in so many ways. The points where two bones meet are called joints, and your leg has many different types of joints.

Hinges and Gliders

Your knee and ankle joints work like hinges allowing your leg and foot to flex back and forth. The joints that connect your toes to your foot are known as arthrodial joints. They allow a gliding motion that lets you wiggle your toes.

Ball-and-Socket

Your hip is a ball-and-socket joint. The rounded top of the femur, or thigh bone, fits into a cuplike space in the hip. Without muscles and ligaments to restrain it, your leg could rotate in a complete circle around the hip. This is why gymnasts and dancers, whose muscles and ligaments are extremely flexible, can perform splits in different directions.

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What does a Stanford-Binet test measure?

THE HUMAN BODY

1. Agility
2. Blood pressure
3. Intelligence

Illustration Gary Fields

©1996 Nintendo

Intelligence Quotient

An IQ test measures a person's intelligence in relation to his or her age.

3 A Stanford-Binet test measures intelligence quotient or IQ.

© Ney Sarah / Explorer

Students of the same age, and in the same class at school, may have different intelligence quotients or IQs.

A person's score on a Stanford-Binet test is used to determine his "mental age." This mental age is divided by the person's chronological, or actual, age and multiplied by 100 to determine his intelligence quotient, or IQ. An average IQ is 100. If a person's mental age is equal to his chronological age his IQ will be 100.

Judging Performance

If a person's mental age is higher than his chronological age, his IQ will be higher. This indicates that the person might be more intelligent than other people his age. An IQ below 100, could indicate that a person's intelligence is below the level of other people his age.

Not a Perfect Solution

IQ tests are not perfect. Most do not take into account where a person lives and knowledge he gains from his surroundings. They also don't account for intelligent people who suffer from learning disabilities such as dyslexia. Most psychologists agree IQ tests are useful, but shouldn't be the only gauge of a person's intelligence.

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What makes people yawn?

THE HUMAN BODY

1. Inactivity or boredom
2. Hunger
3. Enthusiasm

Illustration: Gary Fields

©1996 Nintendo

Yawning

Doctors don't know why yawning is contagious. Seeing someone yawn makes you yawn too. Even reading about yawning can make you yawn. Are you yawning right now?

1 Inactivity or boredom makes people yawn.

© P. Moulu / Sunset

When a person yawns it doesn't necessarily mean that she is sleepy. She could be bored or just feeling lazy. People yawn less when they are physically active and more when they're sitting around doing nothing.

Yawning is an involuntary reflex; you can't control when it happens. However, you're most likely to yawn when you're bored or physically inactive. A yawn briefly stops blood from leaving your brain. The pause perks you up.

Slowing Down

Doctors and psychologists have not found a conclusive, or definite, reason for why people yawn, or why yawning is contagious. Recently, a group of psychologists conducted a study to determine when people are most likely to yawn. They found that lack of sleep didn't have much to do with yawning. Instead, it seems that people yawn most when they're not physically active or mentally alert. Adults yawn a lot when they attend lectures or drive for long stretches on the highway. Kids yawn when they sit around watching TV.

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What causes hunger pangs?

THE HUMAN BODY

1. Contraction of the stomach muscles
2. Lack of exercise
3. Increased secretion of saliva

Illustration Gary Fields

©1996 Nintendo

Stomach

The walls of the stomach are lined with muscles that are constantly working to break up food and push it along the digestive tract.

1 Hunger pangs are caused by contraction of the stomach muscles.

© S.T.F./Sunset

Hunger pangs are the stomach's signal that it needs more food to digest. When your stomach still has food to digest, you don't feel hungry.

Your body's digestive system breaks down food physically and chemically. When you chew, for example, you break down food physically by grinding it to bits with your teeth. The saliva in your mouth breaks down food chemically by turning starches into raw nutrients. Digestion in the stomach also has physical and chemical components. The stomach secretes an enzyme called pepsin, which breaks down proteins. At the same time, the muscle-lined walls of the stomach contract, or squeeze, repeatedly to break particles of food into smaller pieces.

As the Stomach Churns

It takes about five hours for food to pass through the stomach and into the small intestine. But the empty stomach continues to churn, and the contractions become more frequent. They produce feeling we call hunger pangs—the stomach's signal that it needs more food to digest.

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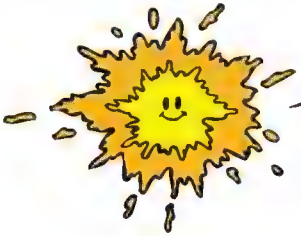
How much of a person's body is composed of water?

THE HUMAN BODY



1. 100%
2. 60%
3. 30%

Illustration, Gary Fields

©1996 Nintendo

Water

About 60% of the adult human body is composed of water—slightly more for men and slightly less for women.

2 A person's body is 60% water.

© P. Moulu / Sunset

After a person exercises, she should drink water to replace the body fluids lost through perspiration.

Water is the main ingredient in all body fluids, including blood, sweat, tears, and saliva. Fluids are the means the body uses to circulate nutrients and oxygen, and to dispose of waste products. Urine, for example, eliminates waste products from the body's digestive system.

Water Sources

The body gets much of the water it needs from the food you eat. Fruits and vegetables, like apples, celery, and, of course, watermelon, contain water. Meat and bread contain water, too. The rest of the water your body needs comes from beverages. Milk and juice contain water, as well as vitamins and nutrients. Thirst is your body's signal that it's running low on water. You crave water when you eat salty food because the salt absorbs much of the saliva in your mouth and throat. You feel thirsty when you exercise because your body loses water in the form of sweat.

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Which connects the mouth to the stomach?

THE HUMAN BODY

1. Esophagus
2. Small Intestine
3. Trachea

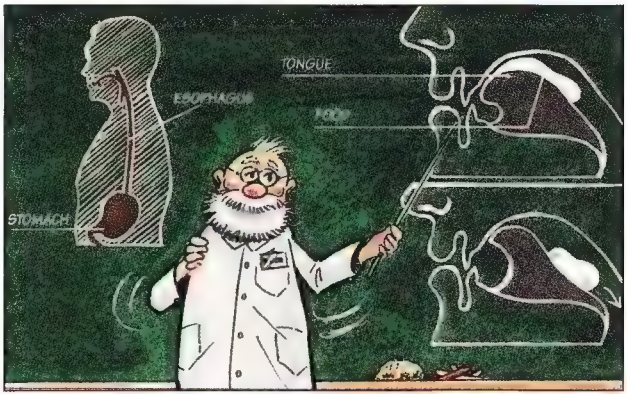
Illustration: Gary Fields

©1996 Nintendo

Esophagus

After you chew and swallow your food, it travels through your esophagus to your stomach, where your body's digestive process continues.

1 The esophagus connects the mouth to the stomach.



© Y. Tabariés

When you swallow, food passes over the tongue and into your throat, where it enters the esophagus. Muscle contractions, called peristalsis, push the food down into your stomach.

Inside your throat are two tubes, side by side—the esophagus and the trachea. The trachea, or windpipe, is a passage for air to enter your lungs. It contains your larynx, or voice box. Next to it is the esophagus, the path food travels from the mouth to the stomach. To make sure that the food goes down the right tube, the trachea is equipped with a flap of soft tissue, called the epiglottis, which closes the trachea when you swallow.

Peristalsis at Work

The esophagus is about 9 inches (23 cm) long, and it leads directly from the mouth to the stomach. Gravity helps food go down, but most of the work is done by muscles that line the esophagus walls. As food travels through the esophagus, the muscles contract, or squeeze, to push it down to the stomach. These muscle contractions are called peristalsis.

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What do joints connect?

THE HUMAN BODY

1. Bones
2. Cells
3. Muscles

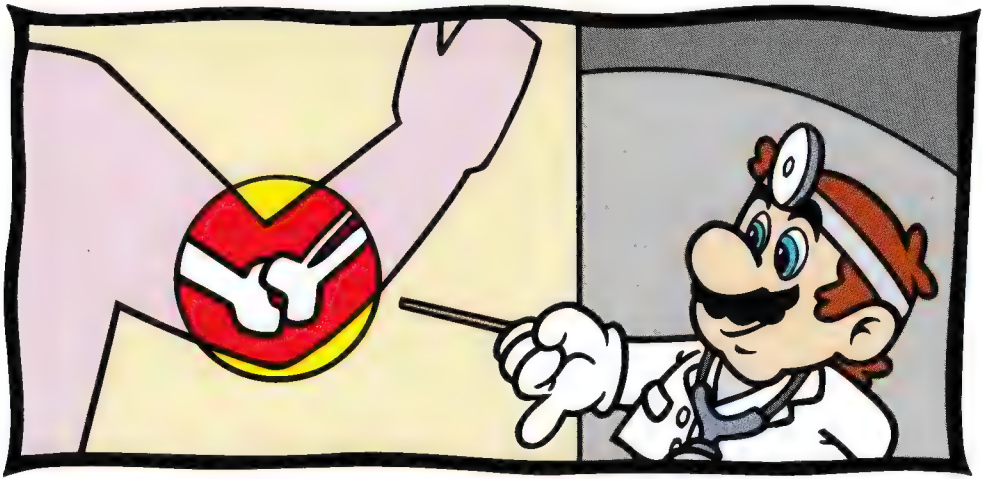

Illustration: Gary Fields

©1996 Nintendo

Joints

The places in your body where bones connect are called joints. Some joints are movable and others are not.

1 Joints connect bones.

© Visuals Unlimited

This is a front view of a human knee joint.

Your skull contains several different segments of bone joined by connective tissue or membranes. These immovable joints are called cranial sutures.

Body in Motion

Movable joints include hinge joints, such as the knee, which move forward and back. Three bones come together at the knee joint, the femur (thigh bone), the tibia (shin bone), and the patella (knee cap).

Other hinge joints include the jaw, ankle, and elbow. Your shoulder and hip are ball-and-socket joints. The ball-shaped top of the femur or the humerus (upper arm bone) fits into a socket, or space, that lets the bone to move freely. This is why you can rotate your arm at the shoulder.

The bones in your spine are joined by amphiarthrodial joints. They work like hinge joints, to allow you to bend, and they also work like arthrodial joints, with a gliding motion that lets you move from side to side.

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What determines your height?

THE HUMAN BODY

1. Climate
2. Education
3. Heredity

Illustration: Gary Fields

©1996 Nintendo

Height

Every person inherits some physical characteristics or traits from his or her parents. This process of natural inheritance is called heredity. Among other things, it influences how tall you are likely to be.

3 Heredity is one of the factors that determines a person's height.

© Goetgheluck / Sunset

Physical characteristics you inherit from your parents are part of what determines how tall you will be. The Masai people of Kenya are generally quite tall. Physical size is a trait that is passed from generation to generation.

If both of your parents are tall, you'll probably be a tall adult. But everyone grows at different rates and times. Kids who are the tallest in their sixth grade class might be just average height by the time they reach twelfth grade.

Growth Factory

In your brain is the tiny, but powerful pituitary gland. It produces chemicals, called hormones, your body needs to grow and mature. One such hormone is called somatotropin—commonly called growth hormone. In childhood, the pituitary releases growth hormone into the bloodstream. It makes bones grow longer and thicker. When kids get to be about 12 years old, the pituitary secretes larger doses of growth hormone, causing most people to go through a growth spurt. Some people don't experience a growth spurt until they're teenagers.

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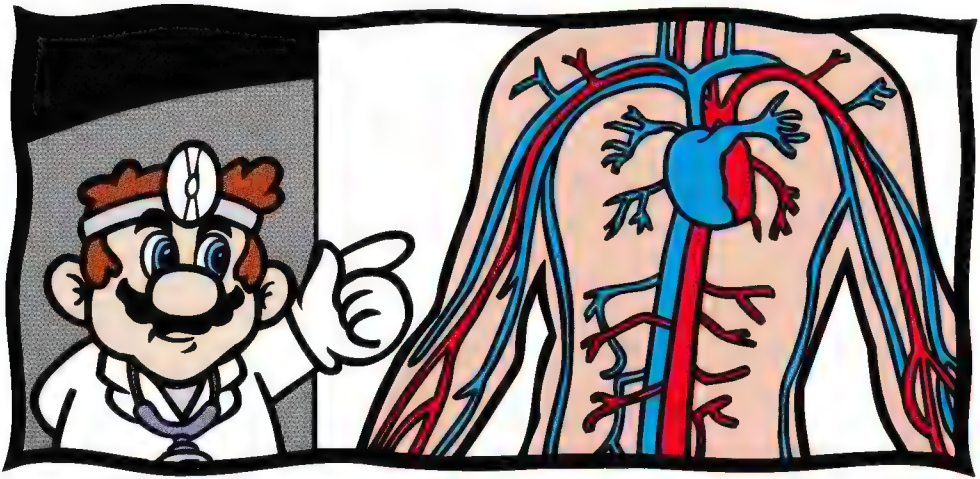
What are tiny blood vessels called?

THE HUMAN BODY

1 Capillaries

2 Catapults

3 Cavities



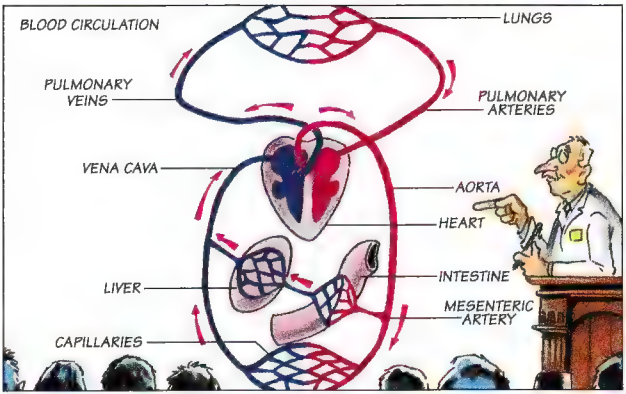
Illustration, Gary Fields

©1997 Nintendo

Capillaries

Blood transports oxygen and nutrients to the cells throughout the body. It travels through pathways known as blood vessels. Capillaries are tiny blood vessels.

1 Capillaries are tiny blood vessels.



The heart pumps blue blood to the lungs, where it mixes with oxygen, and it turns red. Red blood is pumped to the body through an artery called the aorta. Capillaries in the liver collect blue blood from other organs. A vein called the vena cava returns it to the heart.

The large blood vessels in your body are the veins and the arteries. Branching off from them are the capillaries. The whole system of blood vessels curls and bends to fit inside your body, but if you were to lay all your blood vessels end to end they'd be long enough to wrap around Earth twice!

Oxygen Delivery

The heart's pumping action forces blood through the blood vessels. From the heart, it flows to the lungs where it mixes with oxygen, which makes the blood red.

Capillaries at the ends of the arteries connect to capillaries at the ends of the veins. The veins carry blue blood back to the heart and the circulation process begins again.

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What connects the trachea to the lungs?

THE HUMAN BODY

1. Bronchi
2. Duodenum
3. Esophagus

Illustration: Gary Fields

©1997 Nintendo

Bronchi

The trachea, or windpipe, is a passageway inside your throat which carries air toward the lungs. At its base, the trachea splits into two tubes called bronchi.

1 The bronchi connect the trachea to the lungs.

© Taulin / BSIP

A case of bronchitis can make you feel awful. It causes coughing and makes it hard to breathe. The influenza, or flu, virus sometimes causes bronchitis.

Each bronchus leads to a lung. Inside the lungs, the bronchi branch off further into narrow channels called bronchioles. The bronchioles end in clusters of cells called alveoli. They look like tiny bunches of grapes—with each grape about the size of a pinhead. This is where blood absorbs the oxygen it carries to the rest of the body.

Chest Congestion

The walls of the bronchi are lined with moist tissue called mucous membranes. When these membranes become irritated and inflamed, it results in a condition called bronchitis. Sometimes bronchitis is caused by a virus—like the flu. It can also be brought on by air pollution, dust, or cigarette smoking.

Even breathing cold dry air can irritate the bronchi. This is why it sometimes causes chest pains to inhale deeply on a very cold day.

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Do all humans have the same number of chromosomes?

THE HUMAN BODY

1. Yes, all humans have 46 chromosomes.
2. No, males have more chromosomes than females.
3. No, children have fewer than adults.

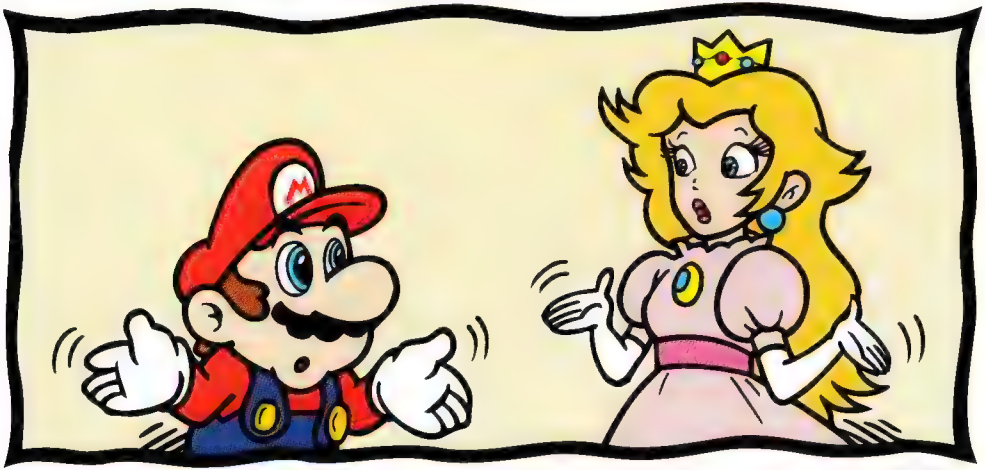

Illustration: Gary Fields

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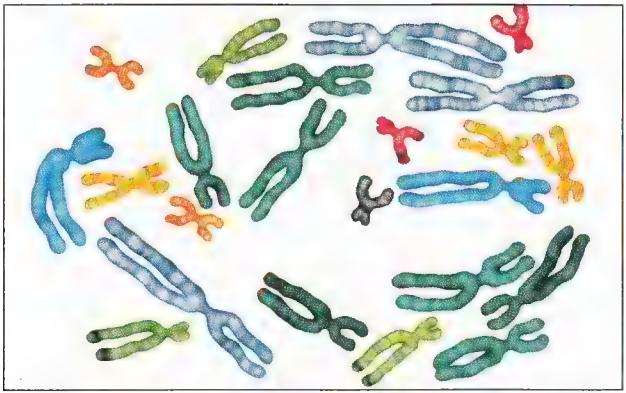
Chromosomes

Inside the cells of your body is a sort of blueprint, or plan, for all your physical characteristics. This blueprint is carried in your chromosomes.

1 Yes, all humans have 46 chromosomes.



© Ducloux / BSIP

Chromosomes are X-shaped. They are made of two strands of DNA, called chromatids, which are joined by a connector called a centromere.

Chromosomes are made up of chains of a substance called deoxyribonucleic acid, or DNA. Contained within the DNA are genes—the basic units of heredity. Your genes contain all the chemical information that determines what you look like, how tall you'll grow, when you will lose your baby teeth, and even when your hair will turn gray. Your genes can also contain some bad news. A person's chances of contracting certain diseases, such as cancer or diabetes, is sometimes determined by his genes.

Pairing Off

Chromosomes always occur in pairs. So, every human cell contains 46 chromosomes, or 23 pairs of chromosomes. A dog has 78 chromosomes, or 39 pairs, in every cell in its body. Plants have chromosomes, too. A pea plant cell contains 14 chromosomes, or 7 pairs.

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Which organ governs equilibrium?

THE HUMAN BODY

1. Ear
2. Heart
3. Liver

Illustration: Gary Fields

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Equilibrium

Equilibrium means balance. Your inner ear governs your body's state of equilibrium, or physical balance.

1 The ear governs equilibrium.

© STF / Sunset

Your inner ear governs your body's equilibrium or balance. It allows you to change positions without feeling dizzy.

Three looped tubes, called semicircular canals, in the inner ear help control your body's sense of balance. The canals are filled with a fluid which moves when you move your head. Receptors inside the canals feel the fluid moving. The receptors send signals to the brain to indicate that the fluid—and therefore the head—has changed position. The brain can then compensate for the shift.

Since the semicircular canals each bend in a different direction, every movement of the head causes the fluid in at least one canal to move.

Integrated Systems

Your eyes and muscles also send messages to the brain indicating a shift in position. Your brain processes all this information in an instant and allows your body to continue to function normally in almost any position. For example, your eyes are able to focus even when you're hanging upside-down.

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Which sense involves the reception of sounds?

THE HUMAN BODY

1 Hearing

2 Sight

3 Smell

Illustration Gary Fields

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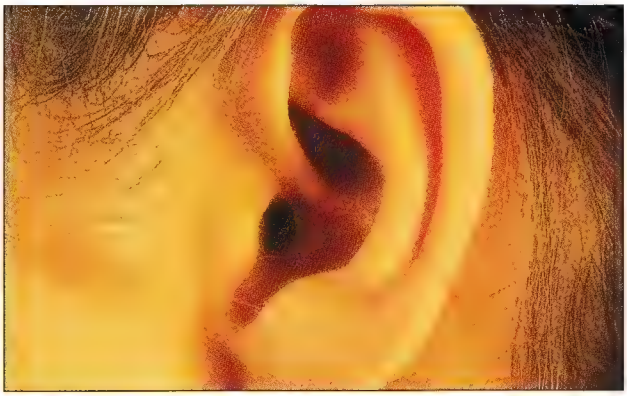
Hearing

The ear is divided into three parts—outer, middle, and inner. Each part of the ear contributes to the process by which we hear.

1 Hearing involves the reception of sounds.



© Krasovsky / BSIP

Your outer ear is shaped like a funnel. It's wide on the outside, but it narrows into a canal that carries sound to the middle ear.

The outer ear—the part you can see on the sides of your head—acts as a funnel to collect sounds. It also protects delicate bones and tissues inside the ear. Wax produced by glands in the outer ear, and the hairs that line the outer part of the ear canal, keep dirt and dust from entering the ear.

Now Hear This

The outer and middle ear are separated by the eardrum, a thin membrane. When sound enters the ear, the eardrum vibrates and it transmits those vibrations to three small bones called the hammer, anvil and stirrup—so named because of their shapes. They, in turn, pass the vibrations to the cochlea in the inner ear.

The cochlea is a spiral chamber that resembles a snail's shell. It's filled with fluid that picks up the vibrations and translates them to electrical impulses that travel to the brain. The brain sorts it all out and helps you recognize the sounds you hear.

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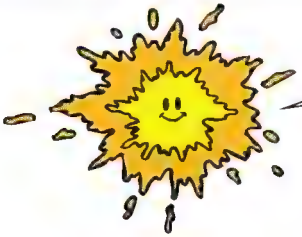
Which muscles are in the front of the upper arm?

THE HUMAN BODY



1. Biceps brachii
2. Triceps brachii
3. Quadriceps femoris

Illustration: Gary Fields

©1997 Nintendo

Muscles

When you bend your arm to make a muscle, the muscle that bulges is the biceps brachii. The word brachii comes from the Latin word *brachium*, which means "arm."

1 The biceps brachii are in the front of the upper arm.

© Moulu / Sunset

You can see this man's biceps bulge when he bends his arms.

The triceps brachii is the muscle in the back of the upper arm. It works in opposition to the biceps. When you bend your arm, the biceps shortens, which makes it bulge. At the same time, the triceps lengthens. When you extend your arm, the biceps lengthens and the triceps shortens. These muscles are attached to your arm bones by stringy tissue called tendons. When the muscles move, they make the bones move.

Muscle Functions

There are three types of muscles in the body. The biceps, triceps and other muscles connected to bones are striated, or striped, muscles. They look like stringy bunches of fibers. Muscles in internal organs, such as intestinal muscles that force food through the digestive tract, are smooth muscles. The heart is comprised of unique muscles called cardiac muscles.

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Where is the pharynx?

THE HUMAN BODY

1. Eye
2. Foot
3. Throat

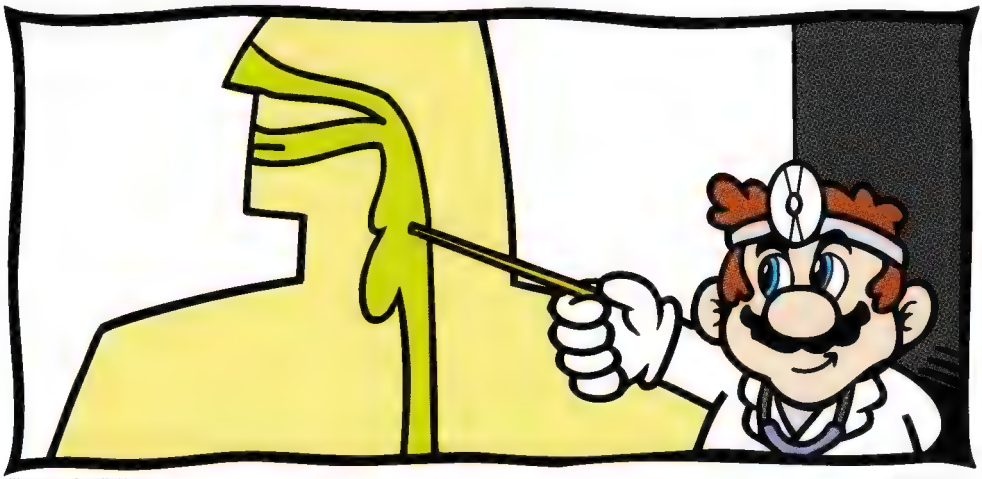

Illustration Gary Fields

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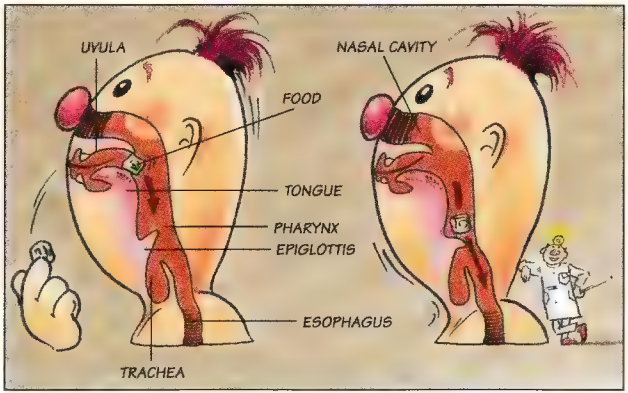
Pharynx

The pharynx carries air from the nose and mouth to the larynx, or voice box. It also carries food from the mouth to the esophagus.

3 The pharynx is in the throat.



© J. Dang

Food passes through the pharynx on its way from the mouth to the stomach.

The pharynx is a connecting tube that stretches from the nasal cavity to the larynx and the esophagus. Not only does it carry food and air into the body, it acts as a vibration chamber that helps transmit the sound of your voice from the larynx through the mouth.

Feeding Time

Without the pharynx you couldn't swallow food and beverages. When you swallow, muscle contractions in your tongue force food back into your throat. The food comes to rest, momentarily, in the pharynx. At this point, the epiglottis—the flap that prevents food from going into the trachea—closes. At the same time, the soft palate moves up to prevent food from rising into the nasal cavity.

Then the walls of the pharynx constrict to force the food further down into the esophagus. The esophagus leads directly to the stomach, where digestion continues.

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Which organ governs the sense of touch?

THE HUMAN BODY

1 Eye

2 Heart

3 Skin

Illustration Gary Fields

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Touch

Like the eyes, ears, nose and mouth, skin is a sensory organ. It governs the sense of touch.

3 The skin is the organ of touch.

© G. Lacz / Sunset

Nerve endings in your fingertips send sensory impulses to your brain.

Your senses are your body's receptors for external stimuli. Your body reacts to the information they provide. Hear a loud noise, and you jump. Taste something sour, and your mouth produces more saliva.

At Your Fingertips

The sense of touch is the perception of pressure on the skin. Nerve endings in your skin register a response based on the pressure they feel. A smooth surface, like a pane of glass, creates a uniform pressure. A rough piece of sandpaper creates different impulses. The impulses travel to the brain where they're interpreted.

Healing Touch

Research has shown that some mammals can't live without being touched. When a mother cat licks her newborn kittens, her touch stimulates activity in their internal organs. Without that little push, the newborns wouldn't grow and develop.

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What is a reflex?

THE HUMAN BODY

1. Automatic, involuntary movement
2. Movement done only in sleep
3. Physical reaction to pain

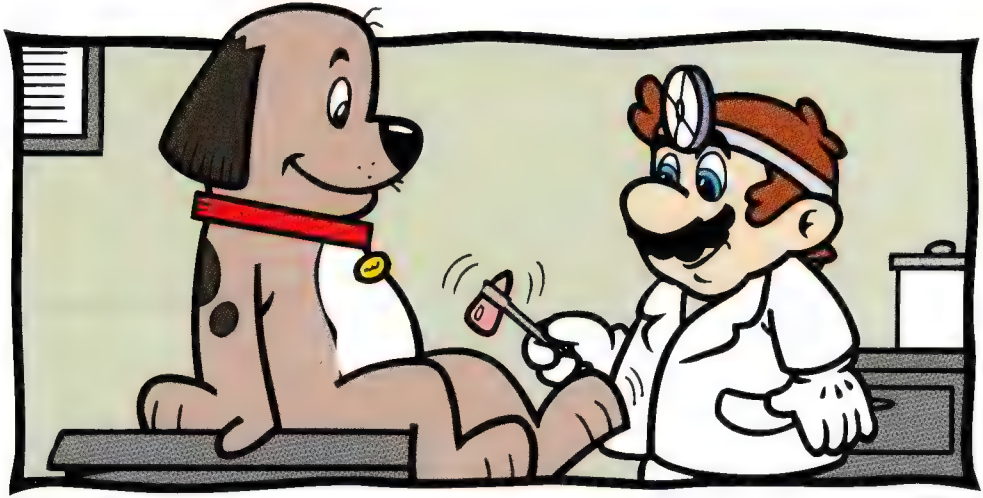

Illustration: Gary Fields

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Reflex

You can control many of your body's movements—like shaking your head or raising your hand in class. But there are some physical responses that are beyond your conscious control. They're called reflexes.

1 A reflex is an automatic, involuntary movement.

© Sarah Ney / Explorer

Babies demonstrate some reflexes at birth. They blink, they breathe, and their mouths produce saliva when they eat.

One of the body's reflexes is blinking. It's true that you can consciously open and close your eyes, but most of the time blinking is an automatic, unconscious reflex. Your eyes blink to keep the corneas moist and clean. Did you know that, on average, humans blink more than 17,000 times a day? If you had to think about blinking every time you did it, you wouldn't have time to think about anything else!

Reflex Action

Some of your body's reflexes occur in response to a particular stimulus. For example, when you put food into your mouth, your glands produce saliva. The saliva starts the digestive process and it moistens the food for swallowing.

When you're cold, your skin breaks out in goose bumps. This reflex contracts the muscle fibers in the skin and raises body temperature.

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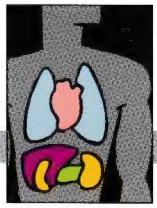
Which is a sign of dreaming?



THE HUMAN BODY

1. Rapid eye movement
2. Snoring
3. Somnambulism

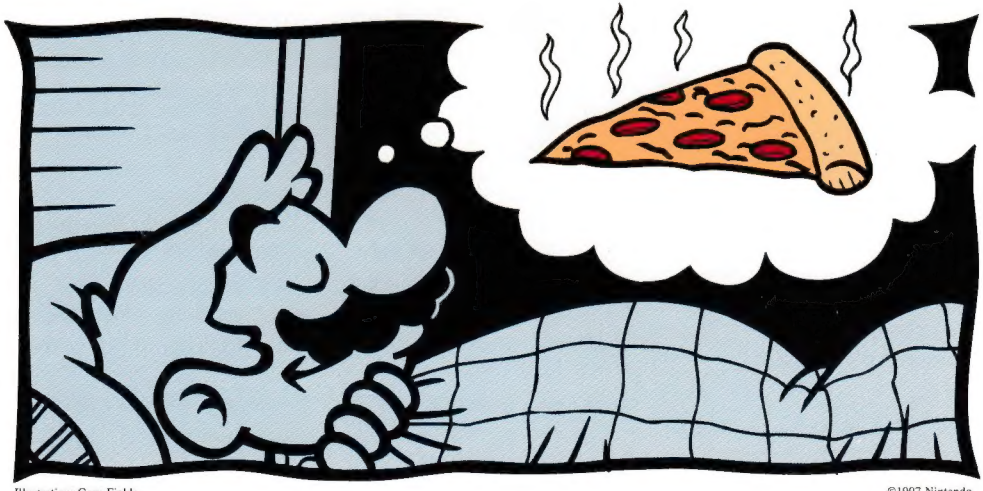


Illustration: Gary Fields

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Rapid Eye Movement

The average person experiences five dreams during a full night's sleep. The dreams last longer as the night goes on.

1 Rapid eye movement is a sign of dreaming.

© Dandier / Jerrican

A subject in a sleep lab is connected to an electroencephalogram, or EEG, which monitors brain activity; an electromyogram, or EMG, which monitors muscle activity; and an electroculogram, or EOG, which monitors eye movement.

The study of sleep and dreams is a discipline in the field of psychology. Psychologists at hospitals and universities operate "sleep labs" in which they observe and record people's behavior while they sleep. These observations have led to discoveries about what happens in your mind and body when you sleep and dream.

Dream State

The process of sleep can be divided into four stages based on the activity of the brain, muscles, heart, and other bodily functions. Following these four stages, your body enters a rapid eye movement, or REM, state. This is when most of your dreams occur. During REM sleep your brain and muscles function at opposing levels of alertness. The brain is highly alert, but the muscles are not. This is why you have vivid mental pictures in your dreams, but your body does not act them out.

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What is the name for the shoulder blade?

THE HUMAN BODY

1 Clavicle

2 Humerus

3 Scapula

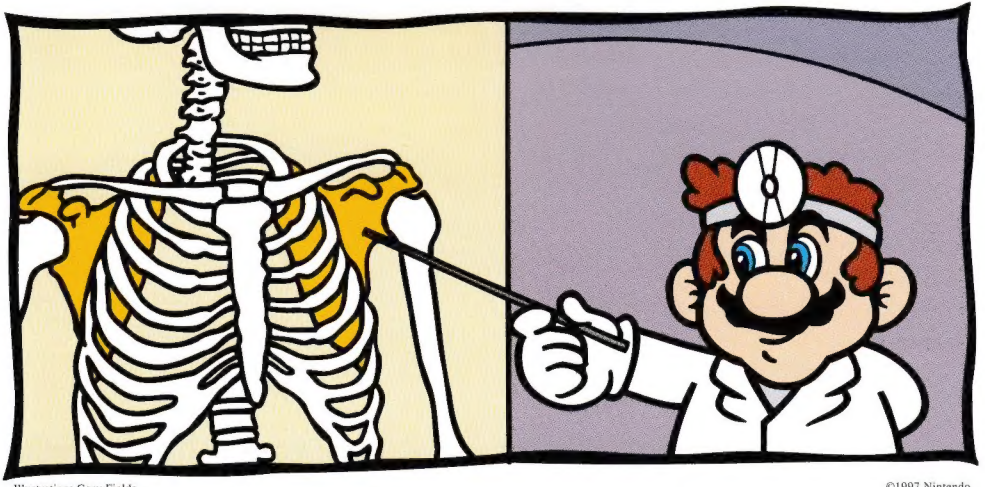

Illustration: Gary Fields

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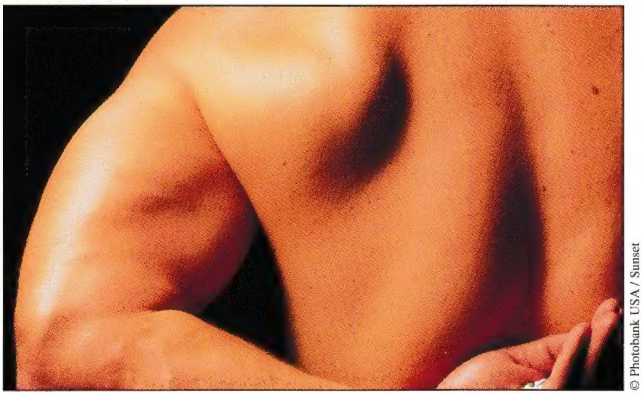
Scapula

The scapula, or shoulder blade, is a large triangular bone in the back of the shoulder.

3 The shoulder blade is called the scapula.



© Photobank USA / Sunset

The scapula, or shoulder blade, protrudes slightly when you move your arm.

At its top, the scapula is connected to the collar bone or clavicle. In the front, the scapula is connected to the upper arm bone, called the humerus.

Several muscles allow the scapula to move. The trapezius muscle, for example, also helps you tilt your head in all directions.

Athletic Injury

Shoulder injuries are common among athletes. Though the shoulder is a muscular joint, its construction is complex and the bones surrounding it are delicate. Hard contact can easily knock the bones out of position. This is why football and ice hockey players wear shoulder pads to absorb the impact of tackling and checking.

Baseball pitchers are highly susceptible to weakening or tearing of the rotator cuff tendons, which connect shoulder muscles to bones. This is why pitchers "rest" their arms between outings.

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